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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 135
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 136
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 137
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 138
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 138
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 138
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 139

Note: N.A. means that no abstracts were assigned to this category for this issue.

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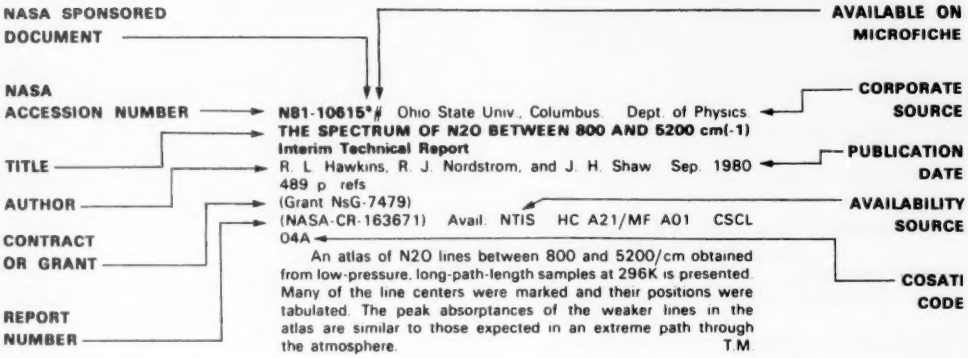
TYPICAL CITATION AND ABSTRACT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N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
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REPORT NUMBER
An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere. T.M.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, GRADUATE STUDENT TRAINING PROGRAM IN COMPUTATIONAL FLUID DYNAMICS

A.R. Seebass, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (NGT 03-002-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

1.0002, RPV (REMOTELY PILOTED VEHICLES) AIR-LAUNCHED PROJECTILE CEP AND ANALYSIS

G. Harris, Developmental Sciences Inc., *15747 E. Valley Blvd., P.O. Box 1264, City of Industry, California* 91749 (DA0E3846; DAAK51 78 C 0008)

To demonstrate by conceptual hardward the feasibility and accuracy of RPV air-launched projectiles (2.75-inch rockets).

Design and build an RPV capable of launching 2.75-inch and VIPER rockets using airborne video data and operator control. After testing, assess techniques and accuracy.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0003, JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS - APPLICATION OF HOLOGRAPHY TO THE STUDY OF HELICOPTER ROTOR FLOW FIELDS

D. Baganoff, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NAG 2-45)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, GRAPHIC ANALYSIS OF COMPUTED THREE-DIMENSIONAL VISCOUS FLOW FIELDS

D. Baganoff, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCA 2-745006)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0005, PHOTODIAGNOSTICS OF TURBULENT FLOWS USING LASER-INDUCED FLUORESCENCE

D. Bershader, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-82)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0006, WIND TUNNEL TEST OF LARGE SCALE ROTOR HUBS (ANALYTIC AND EXPERIMENTAL INVESTIGATION OF THE AIRFLOW AND DRAG OF HELICOPTER HUBS AND PYLONS

R.W. Prouty, Summa Corp., Hughes Helicopters Division, *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0E3783; DAAJ02-77-C-0055)

To improve the complex, turbulent airflow around helicopter rotor hubs and pylons, which causes localized drag and vibration, and which generates a turbulent, energetic wake which strikes the tail rotor, fin and tail boom, causing further aerodynamic problems.

Design and analysis of alternative shapes for hubs and pylons, using two current representative designs (YAH-64 and UH-60a) as baseline designs; test of these shapes in the Langley V/STOL wind tunnel at speeds up to 170 knots, using models to one-quarter-scale and eight-tenths scale. Models will be heavily instrumented to measure pressure distributions, forces and moments, with flow visualization and wake surveys providing off-body aerodynamic parameters.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0007, OPTIMIZATION OF FLOW MANIPULATION PLACEMENT AHEAD OF WIND-TUNNEL CONTRACTION

J. Tan Atichat, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Mechanics & Mechanical & Aerospace Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (NAG 1-74)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0008, MECHANICS OF SURFACE DAMAGE IN ELASTOHYDRODYNAMIC CONTACTS 16005-E

H.S. Cheng, Northwestern University, Evanston Campus, Technological Inst., Dept. of Mechanical Engineering & Astronautical Science, *633 Clark St., Evanston, Illinois* 60201 (DA0G8912; DAAG29-78-G-0199)

To gain a basic understanding of pitting and scuffing failures in heavily loaded lubricated contacts in gears, cams, and rolling element bearings. Relevance - the subject has a high priority in the design of military vehicles and aircraft, particularly in helicopter gear box design.

Analytic and numerical determinations of subsurface stress distributions at asperities will be carried out for normal and tangential surface loads as well as for thermal conditions. Two- and three-dimensional solutions will be formed and related to pitting and scuffing.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0009, THE STUDY OF WAKE PRESSURE RECOVERY AS A FACTOR IN AIRFOIL DESIGN

A.I. Ormsbee, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical

Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (NAG 1-76)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0010, RESEARCH IN THE AREA OF AIRCRAFT DIGITAL CONTROL SYSTEMS
R. Clark, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NCC 4-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

1.0011, GENERAL AVIATION AUTOPILOT STUDY
J. Roskam, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAS 1-16255)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, EFFECTIVENESS OF NONAERODYNAMIC CONTROLS DURING ENTRY OF A SINGLE-STATE-TO-ORBIT VEHICLE
N.X. Vinh, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (NAG 1-86)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0013, DIGITAL FLIGHT CONTROL SYSTEM ADVANCED TECHNIQUES EVALUATION
D.G. Bailey, Honeywell Inc., *2600 Ridgeway Pkwy. N.E., Minneapolis, Minnesota* 55413 (DF140040; F33615-77-C-2070)

Advanced high performance aircraft will be dependent on sophisticated flight controls integrated with other avionics for mission success. Improved survivability of the flight controls against combat damage, equipment failure, and electrical hazards will be required. Advanced digital techniques have the potential for satisfying these requirements but lack the necessary flight test verification that flight control system quality and integrity will not be impacted. The objective of this effort is to flight-test-demonstrate the feasibility of refinements to multimode control laws, analytic redundancy, area multiplexing, and fiber-optic data links. This effort will reduce the technical risk and increase the confidence that these advanced digital techniques do not compromise flight control system performance and safety. It will also demonstrate the improved target tracking achieved through software refinements.

Existing multimode control laws in YA-7D (67-14583) will be refined through software reprogramming to optimize flight path performance during turning maneuvers. Software coding will be developed for fault tolerance through analytical redundancy and tested on the aircraft. A dais-type area multiplexing data bus per MIL-STD-1553 will be developed to be compatible with the existing dual HDC-301 computers and flight-tested for suitability of performing the flight stabilization and control functions. An optically coupled data bus will be investigated by exchanging the twisted shielded pair transmission lines with a fiber-optic cable, including optical line drivers and receivers, and flight-tested. A test program will be conducted to evaluate the potential susceptibility of the multiplexed data bus flight control system to lightning-induced voltages. Using the multiplexed data bus, an improved dynamic gun sight will be added to further investigate target tracking capabilities of the multimode control laws.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, NONLINEAR ANALYSIS AND DESIGN OF SUPERSONIC AIRCRAFT
F.J. Marconi, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF140820; F33615-77-C-3126)

A more accurate method for analyzing advanced supersonic aircraft configurations over a wide range of flight parameters is required beyond the present linear methods. The nonlinear analysis/design methods will enable handling realistic future military-type aircraft geometries. There will be significant acquisition cost savings due to the accuracy and the reliability of the methods. The objective of the effort is to generate a user-oriented computer code that gives the aerodynamic parameters of interest and detailed flow field characteristics around the aircraft. Military aircraft not only will have complex geometries but also operate over a wide range of flight parameters. These problems are nonlinear in nature and therefore nonlinear methods are required to generate reliable data useful for designers.

Cross-sectional geometries of aircraft will be transformed conformally into simpler shapes, such as circles and rectangles, and the appropriate nonlinear Eulerian equations will be solved by finite difference techniques. Reliability of the schemes will be established.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, GRADUATE STUDENT TRAINING PROGRAM IN COMPUTATIONAL FLUID DYNAMICS
P.R. Garabedian, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (NGT 33-016-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

1.0016, GRADUATE STUDENT TRAINING PROGRAM IN COMPUTATIONAL FLUID DYNAMICS
S.G. Rubin, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering & Applied Mechanics, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NGT 36-004-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology

1.0017, CONTROL AUGMENTATION FOR LATERAL CONTROL WHEEL STEERING
R.H. Foulkes, Youngstown State University, School of Engineering, Dept. of Electrical Engineering, *Youngstown, Ohio* 44505 (NAG 1-88)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0018, TIME-DEPENDENT LOCAL HEAT TRANSFER COEFFICIENT VARIATIONS DURING THE ICE ACCRETION PROCESS ON AIRCRAFT SURFACES
E.G. Keshock, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAG 3-83)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0019, VALIDATION OF AEROELASTIC TAILORING BY STATIC AEROELASTIC AND FLUTTER TESTS
A.E. Allis, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF138210; F33615-77-C-3105)

This work supports the functional area of aircraft aeroelastic design involving flight safety and improved aerodynamic performance. Aeroelastic tailoring of composites offers the potential of designing aircraft lifting surfaces to be free from aeroelastic instabilities, providing the required strength margins and improving certain aerodynamic qualities, such as improved lift or reduced drag. The work unit will address the validation and quantification of the benefits obtainable through aeroelastic tailoring. The specific objective of this work is to experimentally verify that aeroelastic tailoring of filamentary composite structures for Air Force aircraft will enhance performance and provide a life cycle cost savings. Preliminary analysis results indi-

cate ten percent improvement in turn rate and range can be achieved for a lightweight fighter design and a 15 percent range improvement is possible for a bomber design when aeroelastic tailoring is incorporated. In order to be a usable design concept, an aeroelastically tailored design must also be compatible with cost-effective manufacturing concepts, retain the tailored stiffness and strength throughout the service life of the aircraft, and demonstrate the performance gains.

To adequately demonstrate the capability to meet the above-stated objectives, scaled models of a representative configuration will be tested to measure aerodynamic performance and deflections under actual airloads and to determine flutter characteristics in a wind tunnel. The tailored stiffness properties of the full-scale design will be scaled in the static aeroelastic model for transonic testing. Stiffness and mass will be scaled in the flutter model. The models will be fabricated in composite materials to duplicate the anisotropic properties. Prior to wind tunnel testing, static load deflection and proof tests will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, STATIC ELECTRICITY SENSOR INVESTIGATION

O. Tranbarger, Southwest Research Inst., *8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas* 78228 (DA0G0466; DAAK51-79-C-0060)

To conceive, analyze, and evaluate innovative schemes of measuring or inferring the electrostatic potential on helicopters.

Conduct mathematical analysis of electrostatic environment surrounding helicopter; design and fabricate test chamber and test articles; conduct tests of electrostatic environment to establish effectiveness of electrostatic potential measurement scheme; analyze results.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0021, PRELIMINARY DEMONSTRATION OF A ROBUST CONTROLLER DESIGN METHOD

L.R. Anderson, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace & Ocean Engineering, *Blacksburg, Virginia* 24061 (NAG 1-80)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0022, EVALUATION OF BLADE TIP PLANFORM EFFECTS ON HOVER PERFORMANCE - ARMY HELICOPTER

M. Summa, Analytical Methods Inc., *110 116th Ave. S.E., Bellevue, Washington* 98004 (DA0D4081; DAAJ02-76-C-0069)

To develop a mathematical analysis, based on lifting surface theory, for the prediction of helicopter rotor performance in hover and in a vertical climb.

Portions of existing analyses will be modified and combined to provide an analysis capable of modeling rotor blades with arbitrary radial variations in planform, twist, and airfoil section. The analysis will be based on the vortex lattice method and will include a free wake analysis, a boundary layer analysis, and representations of blade thickness, flow viscosity, and flow compressibility effects. This analysis will be used to predict Cp-Ct curves and blade loading distributions to be correlated with existing test data and to be compared with the corresponding predictions from a lifting line analysis and a blade element momentum analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0023, ADVANCED FIBER-REINFORCED THERMOPLASTICS (AFRTP) FOR AIRCRAFT STRUCTURES

J.T. Hoggatt, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF136020; F33615-76-C-3048)

Although significant advancements have been made in reducing the weight of aircraft structures through the use of advanced composites, further reductions in ownership and especially acquisition costs are potentially available through the substitution of thermoplastic matrix materials for the present thermosetting matrix materials (such as epoxies). Flat thermoplastic laminates can potentially be laid up and consolidated with highly automated processes, they can be stored without refrigeration as long as necessary (as can the thermoplastic adhesives) and they can then be postformed into complex shapes by applying heat and pressure. In addition, the thermoplastics can be welded in seconds either ultrasonically or with an electromagnetic vibration welding technique. The objectives of the program are (1) to demonstrate the potential of advanced fiber-reinforced thermoplastics (AFRTP) to reduce the fabrication and assembly costs of aircraft structures, (2) to demonstrate the structural integrity and durability of an AFRTP component, and (3) to simplify the repair procedures and reduce the cost of maintaining advanced composite structures.

The approach to attaining the objectives is to select a structural component from either an operational system or a future production system, redesign the component, develop the manufacturing and repair techniques, manufacture the component and thoroughly test it. The selection of the demonstration article is restricted to a component that has a definite potential for acquisition cost savings and/or reduction in maintenance costs on an operational or future production aircraft. This program is sponsored jointly by the Manufacturing Technology Division of the AFML and the Structures Division of the AFFDL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, DEVELOPMENT OF AN ANALYTICAL TECHNIQUE TO PREDICT AIR CUSHIONED LANDING SYSTEM/COMPONENT PERFORMANCE

J. Kilner, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF139640; F33615-77-C-3054)

This work unit supports the development and demonstration of air cushion landing systems, ACLS, for Air Force aircraft. Presently, a reliable analytical technique is not available for evaluating the performance of existing and new, proposed designs for ACLS components as functioning parts of a total flight vehicle system. The objective of this work unit is to develop and verify this needed ACLS prediction technique. Availability of the technique will significantly improve the effectiveness of, and increase the confidence level for, ACLS development and demonstration. Realization of the dramatic improvements to flight vehicle mobility, self-sufficiency, and response promised by ACLS ability to operate on any relatively level surface requires ability to evaluate ACLS performance as part of the total flight vehicle under consideration. The analytical technique developed will provide this needed capability.

An existing aircraft performance prediction computer program will be modified by the addition of system and subsystem subroutines for air cushion system, ACS takeoff and landing systems. Ability will be provided to simulate aircraft equipped with either elastic or inelastic ACS trunks. Then, the computer program shall be verified by simulating the performance of the ACS-equipped Buffalo, XC-8A, aircraft and comparing the results with actual XC-8A ACS takeoff, landing and ground operation data. Next, computer program revisions will be made as required. Finally, a technical report and computer program user's manual will be prepared and delivered along with the computer program which will be checked out and verified for use on the CDC6600 computer at Wright-Patterson AFB.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CHEMISTRY OF POLYNITROETHANE DERIVATIVES

K. Baum, Fluorochem Inc., *6233 N. Irwindale Ave., Azusa, California* 91702 (DA0G8995; DAAG29-79-C-0011)

The preparation and characterization of sym-tetranitroethane, hexanitroethane and tetranitroethylene will be attempted and the mechanism of the reactions involved studied. Relevance - the simple polynitro-compounds are expected to be exceptionally high in energy content, and could be valuable propellant oxidizers or components of explosive mixtures.

Various coupling reactions will be employed, as will displacement and elimination processes, and oxidation and reduction.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0002, CLUSTER VARIATION STUDY OF COHERENT ORDERING IN FCC AND BCC SOLUTIONS

A.J. Ardell, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Materials, *405 Hilgard Ave., Los Angeles, California* 90024 (DA0E9281; DAAG29-78-G-0058)

To apply the cluster variation method to a number of heretofore intractable theoretical problems in the field of coherent order-disorder reactions in BCC and FCC lattices. The research is relevant to Army programs in alloy development, heat treatment of alloys and phase transformations in alloys. As such the research is relevant to problems in development of a whole spectrum of new materials (e.g., clustering in the new amorphous magnetic alloys which may be employed in shielding), as well as the solution of a large number of problems with existing materials (e.g., ordering in commercial nickel-based super-alloys such as Hastelloy B, which are employed in aircraft engines).

The program will include (1) computation of coherent ordering phase diagrams, (2) computation of long-range order parameters in the investigated alloy system as a function of temperature, and (3) computation of short-range order parameters (cluster probabilities) in the investigated alloy systems and comparison with X-ray and neutron diffraction data.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0003, LOCALIZED ELECTROCHEMICAL CORROSION CELLS

B.F. Brown, American University, School of Arts & Sciences, Dept. of Chemistry, *Mass. & Nebraska Aves. N.W., Washington, District of Columbia* 20016 (DA0F9298; DAAG29-78-G-0165)

To determine the solution chemistry of electrolytes existing in localized corrosion cells (e.g., pits and propagating stress corrosion cracks), and to investigate the corrosion behavior of metals in these solutions. Relevance - the research has relevance to inhibition of corrosion and catastrophic failure in aircraft, mobility vehicle structures and lightweight armor.

Macroscopic cells will be utilized which contain the concentrated electrolyte as determined by experimental measurements on solutions in propagating cracks in aluminum and other metals. Aluminum and other metal specimens will be exposed to the concentrated electrolyte to determine corrosion response, effect of environment on rate of repassivation of newly exposed surfaces, and electrochemical reaction kinetics of the specimen electrodes as functions of electrolyte chemistry.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0004, MECHANISTIC STUDIES OF THE EFFECT OF LEAD SALTS ON DOUBLE-BASE PROPELLANT COMBUSTION - THE USE OF MODEL SYSTEMS

J.B. Levy, George Washington University, Columbian College Arts & Sciences, Dept. of Chemistry, *2121 Eye St. N.W., Washington, District of Columbia* 20037 (DA0V5574; DAAG29 76 G0087)

To investigate the effect of lead salts on the kinetics and the mechanism of combustion of double-base propellants. The results will have direct application to Army programs involving the combustion and ignition of propellants. In particular, this project is directly relevant to the Interior Ballistics Laboratory's ongoing project on the mechanism and chemical kinetics of nitrocellulose decomposition.

Burning rates of the solid propellant will be measured as functions of pressure, composition, the presence of catalyst, particle size and other relevant parameters as they become apparent. Temperature profiles will also be measured. In addition, models for the combustion process will be developed using both the data from the solid propellant studies in conjunction with combustion data on simple systems such as the nitrate esters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0005, FREQUENCY RESPONSE ANALYZER/PROCESSOR FOR DIAGNOSTIC STUDIES OF POROUS ELECTRODES AND POROUS FLOW BEDS

J.R. Selman, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Chemical Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (CPE79-23967)

This funding provides support to purchase a frequency-response analysis and processing system. This equipment will be used jointly by the Electrochemical Engineering Group and by the Enhanced Oil Recovery Group in the Department of Chemical Engineering. This equipment will be applied to two research areas: 1) frequency response of porous electrodes in batteries and fuel cells as a diagnostic tool in identifying the rate-limiting processes in these devices; 2) analysis of liquid-liquid and liquid-gas flow patterns in porous matrix materials.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Chemical & Process Engineering

3.0006, CORROSION FATIGUE BEHAVIOR OF ALUMINUM ALLOYS

J.H. Mulhern, Materials Research Lab. Inc., *1 Service Rd., Glenwood, Illinois* 60425 (DA0B0677; TO BE DETERMINED)

This proposed contract effort will be the result of an unsolicited proposal which has been received from Materials Research Laboratory, Inc. The objective of the work is to investigate the corrosion fatigue behavior of both 7000 series powder metallurgy and ingot metallurgy aluminum alloys in both inert and aggressive environments. The fatigue behavior will be determined by measurements of the fatigue crack growth rate at high delta-K values. Such work is of extreme importance to helicopter structural parts, bridging and tank automotive structures.

The fatigue crack growth rate will be measured at various high delta-K values from 7075-T6 and a new aluminum powder metallurgy alloy, MA87. The variables to be examined are the environment, frequency, wave form, and stress intensity ratios. The influence of these variables will be described in terms of fracture mechanics paramaters.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

3.0007, HYDROGEN ENTRY AND TRANSPORT MECHANISMS IN STRUCTURAL METALS

R.H. Heidersbach, University of Rhode Island, School of Engineering, Dept. of Ocean Engineering, *Administration Bldg., Kingston, Rhode Island* 02881 (DA0E9200; DAAG29 76 G0311)

To investigate hydrogen transport characteristics of structural metals, with emphasis on high hydrogen flux levels, as occur in hydrogen embrittlement cracking, and to investigate surface-entry mechanisms for hydrogen with and without the presence of molecular species which enhance hydrogen entry. Relevance - the research is complementary to a current study on the stress corrosion cracking characteristics of ESR and other high strength steels. Also, the Army has experienced failures of 7075-T6 aluminum, probably due to stress corrosion

cracking. The structural alloys to be investigated are widely used by the Army in helicopters, ground mobility equipment, tanks, cannons, armored vehicles, and bridges.

(1) Samples of as-cast and also electroslag-remelted (ESR) steels will be subjected to a selected set of controlled hydrogen fluxes, to examine the effect of remelt practice and subsequent impurity levels and microstructure on hydrogen transport. (2) Samples of 7xxx-series aluminum alloys will be studied as above in (1) to investigate the effect of aging on hydrogen susceptibility. (3) Utilization of infrared and Raman spectroscopy to study intermediate surface reactions which enhance hydrogen entry.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0008, MULTI-ION INTERACTIONS IN NON-TRANSITION METALS

R.E. Beissner, Southwest Research Inst., *8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas* 78228 (DA0G9055; DAAG29-79-C-0099)

To develop a first-principles thoery of interatomic potentials between point defects and host non-transition metal atoms. Relevance -the research is directly relevant to ongoing work at AMMRC on molecular dynamics calculations of defect structures to determine equilibrium and non-equilibrium properties of defect structures as they affect thermomechanical properties of metals and alloys.

Many-body theoretic methods of physics that use Green's functions in P.I.'s versions of 'multi-ion expansion' will be used. The screening charge densities for and consequent electric field gradients at point defects will be calculated and compared with exprimental data.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0009, ENGINES/SHALE FUEL COMPATIBILITY ASSESSMENT

E.C. Owens, Southwest Research Inst., *8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas* 78228 (DA0G2854; DAAK70-80-C-0001)

Identify items of existing or planned Army ground support engine-driven and fuel-consuming equipment, and develop a plan to verify that this equipment will/will not operate satisfactorily on shale-derived gasoline, diesel and turbine fuels refined to meet existing petroleum specifications.

Conduct a comprehensive review of existing laboratory and field data to determine what fuel properties have already be identified as causing operational difficulties on existing engines; define performance areas sensitive to fuel properties; select candidate test items; develop a test plan to verify shale fuel operation.

SUPPORTED BY U.S. Dept. of Defense, Mobility Equipment Research & Development Command, Electrochemical Div.

3.0010, NON-EQUILIBRIUM MATERIAL EFFECTS ON BEHAVIOR OF POLYMERIC COMPOSITE MATRICES AND THEIR RELATED COMPOSITES

G.L. Wilkes, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Chemical Engineering, *Blacksburg, Virginia* 24061 (NAG 1-78)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0011, STRESS-INDUCED EFFECTS UPON STRUCTURE AND PROPERTIES OF CARBON FIBERS

D.B. Fischbach, University of Washington, School of Engineering, Dept. of Ceramic Engineering, *206 Guggenheim Hall, Seattle, Washington* 98105 (DA0E9045; DAAG29-78-G-0142)

To study the stress-induced physical behavior of carbon fibers and the detailed influence of microstructure on their piezoresistance and dynamic mechanical properties. This research is relevant to the Army's need for stronger, stiffer, and less expensive lightweight fibers for reinforcement of composite materials for Army aircraft, missiles, and electrical power storage and distribution. Graphite-reinforced metal matrix composites are being proposed for bridge supports, storage batteries, helicopter transmission housings, turbine fan blades, and parts of the super-flywheel.

The program will include (1) determination of the effects of various thermal treatments on structure and properties, (2) study of the structure and properties of new pitch-mesophase and CVD carbon fibers, (3) determination of the temperature-dependence of the dynamic mechanical relaxation effects in the range 100-500K, (4) characterization of the microstructure of carbon fibers using such techniques as electron microscopy, X-ray diffraction and magnetic measurements, and (5) formulation of an analytical anisotropic elasticity model.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, MIXED FLOW COMPRESSOR

J.L. Dodge, Signal Co. Inc., Airesearch Manufacturing Company, *402 S. 36th St., Phoenix, Arizona* 85034 (DF459910; F33615-79-C-2028)

Design, development and demonstration of a single stage mixed flow compressor that exhibits performance equivalent to today's state-of-the-art multi-stage axial compressor at substantially lower cost.

The program includes mechanical design and development in parallel with aerodynamic design of a single stage mixed flow compressor. Complete mapping of the compressor under simulated engine test conditions would follow the fabrication phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0002, X-RAY PRODUCTION IN DENSE PLASMA FOCUS

D.C. Gates, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF042570; F44620-76-C-0034)

AF function - the AF has the responsibility of assuring that its systems are hardened to withstand radiation effects from nuclear weapons detonations. Deficiency - no simulator has yet been developed which can satisfy requirements for simulating in a laboratory environment the radiation effects of a nuclear weapon. Objective - this program has as its objective improving the radiation efficiency of the plasma focus device. This objective has three parts - (1) improving the electrical efficiency by operating at higher voltages, (2) improving the plasma radiation efficiency by selectively introducing high-Z material into the focus region, and (3) exploring external heating methods such as adding energy directly to the focus region using a relativistic electron beam. Contribution - this research is a part of a comprehensive program for the development of a radiation source for simulation of nuclear weapons effects.

SRI will investigate methods of improving current sheet propagation and transfer of energy in the plasma focus by (a) operating at high voltages, (b) using suitable configurations of electrodes and breech insulators, and (c) tailoring of the gas distribution along the electrode. By using a positive/negative charging system, the capacitor bank voltage will be doubled to 120 kV. As at 60 kV, the efficiency of energy transferred to the plasma gun will be measured and compared with theoretical models. They will study methods of introducing high-Z materials into the plasma focus by (a) introducing a pulsed cloud of high-Z gas on the axis, and (b) placing a thin, hollow cylindrical foil on the axis. Argon K-alpha X-rays will be measured with Ross filter pairs in front of pin silicon detectors. The total X-ray yield will be measured with a thermopile calorimeter. These filter-detector combinations will be designed by using the Glint computer code. These X-ray measurements will be used to

evaluate the presence of relativistic electron beams in the plasma focus. Anode tip geometries and puffed gas conditions will be varied to note the effect upon the X-ray yield and spectrum and the acceleration of electrons in the plasma focus.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0003, LATITUDINAL VARIATIONS OF AURORAL ZONE IONIZATION DISTRIBUTIONS
J. Vickrey, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF057060; F49620-80-C-0014)

AF function - many weapons systems are ionospheric-dependent, such as the surveillance (OTH/B), HF communications, and space-based navigation systems (GPS). The design and operation of future such systems will be even more dependent upon our ability to specify and forecast the state of the ionosphere on a variety of various time and distance scales. The auroral zone presents particularly difficult problems due to the large energies deposited there and sharp discontinuities which result. Opportunity - the Chatanika incoherent scatter radar is situated on the southern edge of the auroral oval and is capable of measuring energy deposition due to particle precipitation and joules heating, the ionization profile and its spatial variability, and the neutral and plasma dynamics. The ionosphere may be surveyed over a geomagnetic latitude range of 62 to 68 degrees in the E region and 56 to 73 degrees in the F region every 12 minutes with a spatial resolution of 10 km. Objective - to analyze several data sets of nearly 24-hour lengths when constant elevation measurements were made to quantitatively characterize the following: particle precipitation, energy deposition and enhanced electron densities, ionospheric electric fields, and ionization transport and heating. How work contributes - OTH radar and other ionospheric-dependent weapons systems will benefit from the increased knowledge of ability to model the auroral ionosphere.

Historical constant elevation measurements from the Chatanika radar will be analyzed for a variety of geophysical parameters to determine their diurnal and short-term variabiltiy under a variety of magnetic and auroral activity. Available ancillary data (all-sky camera photographs, DMSP auroral images, magnetograms, etc.) will be used to better understand the processes. The analysis will focus upon the determination of a general morphological description of auroral phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, RESEARCH ON NEW APPROACHES TO OPTICAL SYSTEMS FOR INERTIAL ROTATION SENSING
M. Chodorow, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DF044420; AFOSR-76-3070)

AF function - navigation, guidance and control of aircraft, spacecraft and missiles require sensors of angular rotation rate in inertial space. However, conventional gyroscopic sensors pose cost and adaptation problems. Opportunity - although the coming use of ring lasers in strapdown systems will offer considerable advantages, proper use of new integrated optics and integrated circuit advances will minimize the cost and maximize the adaptability and availability of these new sensors which allow the direct measurement of absolute inertial rotation rate without requiring comparison with other standards for calibration. Objective - the intrinsic limitations of ring lasers are to be avoided by new approaches which have the potential for integrated optics implementation and high performance cost ratio. How work contributes - this research should lead to devices which are free from lock-in and bias effects encountered in conventional laser gyros, have high sensitivity and accuracy and allow ready adaptation to specific requirements such as size reduction, cost decrease or sensitivity increase and adaptation to a specific environment and geometry.

The new approaches are based on the Sagnac effect like the ring laser. However, in contrast to the latter, the laser source is outside the ring, pulse transmission and amplification in a multiturn loop is used, which leads to a frequency read-out signal equivalent to that of a conventional ring laser. Optical fiber waveguides appear promising for constructing the sensing loops, offering unique advantages in fabrication and application. Calculations have indicated sensitivities in measurement down to very low rotation rates suitable for future navigation systems. This phase of the investigation continues experiments with components of what is referred to as the active re-entrant Sagnac system (ARS) using a CW He-Ne laser and a passive multiple fiber loop, then recirculation and sampling and later active recirculating of pulses from a solid-state laser.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, LABORATORY EXPERIMENTS ON SPACE PLASMAS
F.W. Crawford, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM78-08440)

This grant will support experimental and theoretical research aimed at three basic plasma physics problems, all of which have special significance to space plasma phenomena: First, a primarily laboratory study by spectral methods of the influence of collisions on the excitation and saturation characteristics of ion acoustic waves in a collisionless-to-moderately collisional plasma; next, extensions to realistic antenna geometry and warm plasma effects of the theory of ionospheric pulse propagation, with the aim of utilizing the results for planning a satellite experiment; and finally, an experimental study of double-sheaths, with an emphasis on the magnetic field effects.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0006, RESEARCH STUDIES ON RADIATIVE COLLISIONAL PROCESSES
S.E. Harris, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DA0G2006)

Theoretical and experimental investigation of the physics of radiative collisions and analysis of applications dependent upon these processes. Relevance - the long-term result of this work should lead to the development of frequency up-converters for night vision and radiative collision lasers for high energy laser applications. The use of radiative collisions may allow the optical pumping of high pressure lasers.

Laser-induced charge transfer processes in the visible region of the spectrum to develop correct theory of the process. Electrically excited inert gases to demonstrate radiative collisions with only one laser. Radiative collisional lasers. The use of pair absorption to produce population inversions.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0007, APPLICATION OF RAYLEIGH SCATTERING TO TURBULENT FLOW WITH HEAT TRANSFER AND COMBUSTION
L. Talbot, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (DF038830; F44620-76-C-0083)

AF function - aerospace vehicles, air-breathing propulsion, weaponry. Deficiency/opportunity - experimental study of turbulent flows associated with aerospace vehicles and their propulsion systems has been hampered in the past by the lack of non-intrusive measurement methods suitable for measuring all the desired quantities. Hot wires have produced much important information, but they do disturb the flow, and they cannot survive many of the harsher environments in which it is desired to make measurements. The laser Doppler velocimeter (LDV) techniques promise a new dimension in turbulence measurements, but these can measure flow velocity only. Knowledge of turbulent fluctuations of temperature, gas composition, and gas density, as well as pressure and velocity, would contribute to the body of known information about turbulence and diminish the amount of speculative assumption that goes into scientific and engineering work with turbulent flows. The proposed work

explores the recent innovation in gas velocity and temperature measurement by Rayleigh scattering, combining it with LDV or hot wire methods, to obtain data on both the temperature and velocity turbulence in hostile gas flow environments. Objective - to provide a practical demonstration of the use of Rayleigh-scattered laser light for investigating turbulent flows in a severe environment, and at the same time to gain knowledge of the interaction of turbulence with exothermic reactions or other heat releasing processes in gas flows. How work contributes - many modern applications of gas dynamics involve flows in which chemical reactions occur. It is well known that turbulence in a flow can be amplified by an exothermic chemical reaction. A quantitative correlation between these phenomena could serve to clear-up some troublesome questions about entropy layers, flame zones, and radiating or absorbing flows.

Extensive demonstration of the Rayleigh scattering diagnostic method, in combination with LDV, will be made in experiments. Interaction of a Karman vortex street with a plane laminar flame, interaction of flat plate boundary layer turbulence with a standing flame, and survey of the flow field near a curved standing flame will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, TURBULENT PLASMA HEATING

J.S. Degroot, University of California, Davis Campus, School of Engineering, Dept. of Applied Science, *Davis, California* 95616 (DF044930; F49620-76-C-0014)

AF function - operation of high altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of turbulent plasma heating and X-ray production. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this project will investigate both theoretically and experimentally (a) turbulent plasma heating using electron beams with the required return current and d.c. electric fields, (b) the vacuum spark which may be used as an intense X-ray source. Contribution - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of space and ionospheric communications and the development of countermeasures.

This research will investigate turbulent plasma heating processes taking place in plasma-electron beam interactions, including the effects of the return current and turbulent plasma heating when d.c. electric fields are employed. These data can be scaled to plasma heating employing relativistic electron beams and their use to produce an intense X-ray source. In addition, they will test the efficiency capability of a vacuum spark device as an intense X-ray source. More specifically, they will measure (a) the d.c. anomalous resistivity and heated plasma energy distributions due to the return current and a d.c. electric field, (b) the heating efficiency of double layers to produce very intense electron beams, (c) the X-ray yield and the time-dependence of the soft to hard X-ray intensity from a very fast, high energy vacuum spark.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, DIGITAL FILTERS AND INTEGRAL APPROXIMATION THEORY

L.O. Ferguson, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Applied Science, *Riverside, California* 92502 (DF052230; AFOSR-78-3599)

AF function - to advance the design of cost-effective digital filters for radar, telemetry, and communications systems. Deficiency -the advantages of digital signal processing are so compelling that the AF as well as commercial communications companies is gradually converting all communications to digital systems. The applications, however, still contain some technological and economic problems that prevent the widespread usage of digital methods. Objective - to advance the theory of approximation of rational functions with rational or integer coefficients in order to effectively design realizable filters that closely approximate a desired ideal performance. How work contributes - success in this research could lead to vastly improved digital circuitry for the various electronic systems used in aerospace vehicles and communications networks.

The plan is to apply where possible the results on approximation by polynomials and rational functions with integral coefficients to the present problem of approximating a desired transfer function by rational functions with quantized coefficients, and to extend these results where necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, RADIOMETER MEASUREMENTS OF SNOW-PACK

H.S. Boyne, Colorado State University, School of Forestry & Natural Resources, Dept. of Earth Resources, *Fort Collins, Colorado* 80523 (NAG 5-88)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0011, STRUCTURE OF AUTOMATIC CONTROL SYSTEMS

A.S. Morse, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DF046570; AFOSR-77-3176)

AF function - the design of aerospace and turbojet control systems. Deficiency - the control process is still poorly understood for nonlinear and time-varying systems. Objective - the objective of this research program is to develop concrete analysis and synthesis methods for dealing with the engineering problems encountered in the design of complex control and information systems. How work contributes - this work would provide new aspects from which to analyze the control design problem.

Research will be made in a number of important design problems associated with the identification and control of linear multivariable systems. Included will be the continuation of a fundamental study of self-tuning systems with the objective of developing effective techniques for designing such systems so that they function reliably over a reasonable range of process operating conditions - the study is motivated, in part, by the control requirements of proposed, high performance turbojet engines. A study will be made of the basic properties of nonlinear dynamical systems with input-output maps admitting finite volterra series expansions. An effort will be made to develop systematic procedures for constructing realizations directly from multivariable transfer function data and for designing practical feedback controllers for such systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, DEVELOPMENT OF INSTRUMENTATION FOR MEASUREMENT OF SCATTERING FROM MIRRORS AND BLACK SURFACES

J.F. Lally, Catholic University of America, School of Engineering & Architecture, Dept. of Electrical Engineering, *620 Michigan Ave. N.E., Washington, District of Columbia* 20017 (NAS 5-26226)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0013, APPLICATION OF DISCRETE RANDOM MEDIA TECHNIQUES FOR ACTIVE AND PASSIVE MODELING OF SUBSURFACE MEDIA

R.H. Lang, George Washington University, School of Engineering & Applied Sciences, Dept. of Electrical Engineering & Computer Science, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NAG 5-83)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0014, INTENSE RAINFALL RATES AND THEIR EFFECTS ON MICROWAVE ATTENUATION

H.W. Hiser, University of Miami, School of Engineering & Architecture, Dept. of Mechanical Engineering, *Coral Gables, Florida* 33124 (DA0F9111; DAAG29-77-G-0227)

To investigate intense rainfall rates such as occur in subtropical storms and their effect on microwave attenuation. Relevance - rainfall attenuation of electromagnetic propagation at microwave frequencies poses a serious problem for communication, navigation, homing and other related systems to be deployed for use in the 1980 time-frame.

Three-dimensional models of rainfall rates in intense rain storms such as occur in subtropical storms will be developed using simultaneous measurements from rain gauges, radars and satellites. The resulting models will be used to predict microwave attenuation along horizontal and slant paths through the atmosphere, and to explain the attenuation observed during a 'COMSTAR Satellite K-band Propagation Experiment' conducted by the University of South Florida.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0015, ADVANCED MICROWAVE MOISTURE SOUNDER (AMMS) RAIN MAPPING RADIOMETERS (RMR) AUGUST 1980 B-57 MISSION

J.A. Gagliano, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS 5-26220)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0016, THERMOCAPILLARY FLOWS AND THEIR STABILITY - EFFECTS OF SURFACE LAYERS AND CONTAMINATION

S.H. Davis, Northwestern University, Evanston Campus, Technological Inst., Dept. of Engineering Sciences & Applied Mathematics, *633 Clark St., Evanston, Illinois* 60201 (NAS 8-33881)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0017, STUDY AND DESIGN OF APPROACHES FOR SIMULTANEOUS MULTI-AXIS THRUST MEASUREMENTS OF AIR-BREATHING JET ENGINES

W.G. Schweikhard, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Mechanical Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 3-85)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0018, WAKE STUDIES RELATED TO WAVE-RIDER AERODYNAMIC SHAPES

M. Finston, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF042900; F44620-76-C-0049)

AF function - advanced aerospace vehicles. Opportunity - obtain preliminary aerodynamic information about a possible new class of aerodynamically configured vehicles and reentry bodies. Objective - map the near-wake pressure and temperature characteristics and obtain lift-to-drag data of aerodynamically configured shapes to enable designers and developers to predict possible uses for these new shapes. How work contributes - will provide basic aerodynamic data to enable flight vehicle designers to evaluate possible uses for these new shapes.

An experimental effort at Mach 4.3 and 6.3 is planned using the magnetic suspension of an aerodynamically configured pyramid shape to investigate the lift-to-drag and near-wake characteristics and their dependence on Reynolds number. Prior year experiments indicated that magnetic suspension is the only viable suspension method; string or wire suspension methods produce acceptable blockage and disturbance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, AN INTRODUCTION TO COMPUTER ENGINEERING BASED ON MICROPROCESSORS

J.W. Gray, Southeastern Massachusetts University, School of Engineering, Dept. of Electrical Engineering, *North Dartmouth, Massachusetts* 02747 (SER78-00288)

The objective of this project is to develop a first course in Computer Engineering using the unique properties of the newly emerging microcomputer technology. Since microcomputer systems have the essential features common to all computers, but in a very simplified form (e.g., inexpensive hardward, simple instruction set), they can provide an excellent 'bare bones' introduction to the computer field without the confusing details implicit in larger systems. Furthermore, since microcomputers are now being used as controllers and for digital logic replacements, their use in a junior level Computer Engineering course will provide a 'real world' atmosphere and meaningful coupling to other junior courses such as Electronics and Control Theory. The proposed course would use a specific microcomputer (Intel 8080 or Signetics 2650) and develop judicially chosen hardware and software to 'build' a small computer system. An inexpensive hardware system (board level) and software development aids (cross-assembler, simulator and high level language) which are provided free-of-charge to universities will be used to provide the student with a relevant homework and laboratory environment. The final project will include a full documentation package (e.g., course notes, programs, logic prints and a list of suppliers) which should allow many other schools to introduce such a course with minimum effort.

SUPPORTED BY U.S. National Science Foundation, Directorate for Science Education, Div. of Science Education Resources Improvement

4.0020, PROPAGATION OF DETONATION THROUGH A NON-UNIFORM HETEROGENEOUS MIXTURE

J.A. Nicholls, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (DA0F8962; DAAG29 77 G0104)

To study experimentally and analytically the propagation of a detonation wave through a heterogeneous mixture in which the fuel-to-oxidizer ratio may vary along the path. Relevance - this research will improve the understanding of the influence of fuel/oxidizer ratio and side relief on reactive wave propagation that is required for the development of fuel/air mixtures for munitions. It will further contribute to the studies on pressure instabilities in liquid and solid gun propellant burning.

Liquid fuel drops, all of the same size, will be used and the experimental configuration will correspond to cylindrical geometry. Two different drop sizes will be studied. Distributions of fuel-to-oxidizer ratio with radius which will be examined will include the continuously changing case, the case of uniform ratio except for a void in fuel between radii r1 and r2, and the case of a discontinuity dividing the region into two uniform mixture ratio sections.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0021, RESEARCH STUDY - A STUDY OF HIGH DENSITY BIT TRANSITION REQUIREMENTS VERSUS THE EFFECTS ON BCH ERROR CODING

F.M. Ingels, Mississippi State University, School of Engineering, Dept. of Electrical Engineering, *Suite 101 Engineering Bldg., Mississippi State, Mississippi* 39762 (NAS 8-33887)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0022, UNSTEADY TRANSONIC FLOWS IN A TWO-DIMENSIONAL DIFFUSER

M. Sajben, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF048360; F49620-77-C-0082)

AF function - advanced aerospace vehicles. Opportunity - increase our fundamental knowledge of the parameters which cause dynamic inlet distortion. Objective - the first objective will be to explore experimentally the effects of approach boundary layer properties on the unsteady behavior of two-dimensional, transonic diffuser flow. Upon completion of this, the response of diffuser flows to unsteady perturbations introduced downstream of the diffuser will be experimentally explored. How work contributes - understanding of the mechanisms responsible for the flow unsteadiness will provide the basis for establishing scale laws and developing inlet-compressor matching methods that are based on fundamental principles of fluid mechanics.

Appropriate hardware will be designed and built to permit varying the thickness of the boundary layer approaching the inlet throat. A matrix of test parameters will be established adequate to cover all significant fluctuation modes. Oil flow traces and high speed schlieren movies will be used as visualization techniques. All data will be analyzed and correlated. Upon completion of this phase, hardware will be designed and built which will permit the introduction of external, nearly sinusoidal perturbations at the diffuser exit. A new matrix of test parameters will be established to cover a range of realistic perturbation amplitudes and frequencies and pressure ratios. Data will be collected, analyzed and documented in a form suitable for comparison with theoretical prediction methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, SPUTTERED MERCURY-CADMIUM TELLURIDE MATERIAL FOR INFRARED DETECTORS

R.H. Cornely, New Jersey Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *323 High St., Newark, New Jersey* 07102 (DF047800; AFOSR-77-3249)

AF function - aerospace communications, surveillance and detection systems require electrooptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - materials sensitive in the far infrared region of the electromagnetic spectrum have a high impact for airborne and satellite applications. Objective - the aim of this research is to deposit and examine single crystals of HgCdTe by radio-frequency, triode-sputtering techniques, and to establish the dependence of material parameters such as band-gap, carrier concentration and mobility, chemical composition and film stoichiometry upon deposition parameters such as Hg sputtering gas pressure, film deposition rate, and substrate material, temperature, r.f. bias and presputtering surface treatment. How work contributes - sophisticated electrooptical techniques in narrow band-gap compound semiconductors offer promise for electrooptical microcircuitry and for wide-angled infrared sensing in the 3-5, 8-14, and 18-25 micrometer spectral regions.

The deposition of single crystal, stoichiometric films of (Hg,Cd)Te material involves radio-frequency (r.f.) triode-sputtering in a reactive mercury vapor atmosphere. Obtain a detailed understanding of the conductive, optical and compositional properties of sputtered HgCdTe films by measuring Hall-effect and optical transmissivity and by utilizing Auger spectroscopy, electron and X-ray diffraction methods, and chemical analysis techniques. Explore the methods of forming P- and N-type regions, by Hg vapor changes or simultaneous sputtering of dopants. Study trapping and noise phenomena in sputtered films using field-effect measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, CONVECTIVE IGNITION OF NITROCELLULOSE-BASED PROPELLANTS IN NON-STEADY FLOW FIELDS

W.A. Sirignano, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Engineering, *Box 430, Princeton, New Jersey* 08540 (DA0F9242; DAAG29-79-C-0140)

To continue research on convective ignition of nitrocellulose-based propellants to determine the site and mode of convective ignition of cylinders in cross-flow and to determine the influence of igniter gas composition on the ignition events. Relevance - the results of this research can be incorporated in packed bed propellant studies that are of mission interest to both the Ignition and the Gun Propulsion Technology Programs of the Large Caliber Weapons Systems Lab.

A model is being developed which includes heat-up to gasification, flow of reacting gases around a specified cylinder geometry, and accumulation and reaction of combustion intermediates in the flow wake.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0025, THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS

B.W. Faughnan, RCA Corp., Dept. of Energy Systems Research, *Washington Rd., Princeton, New Jersey* 08540 (147290; ET-78-C-03-1876)

Developing high efficiency solar cells in polycrystalline silicon requires a better understanding of the chemical and defect structure of the intergrain boundaries and their effect on the electrical properties of p-n junctions than is available at this time. Our goal is to obtain an understanding of the electrical properties of grain boundaries as a function of the chemical and defect structure. Our approach is to prepare solar cell structures using polysilicon, then identify and isolate the grain boundaries showing the most degraded photoresponse. Optical and electrical techniques will include laser scanning a fine light spot across grain boundaries while the solar cell photoresponse is measured. The same grain boundaries will be characterized by X-ray methods, mass spectroscopy, and electron microprobe. In addition, grain boundaries of specific misorientation will be grown by Czochralski technique. Transmission electron microscopy will be used to obtain detailed knowledge of the boundary structure. As a result of this work, we expect to learn how to make high efficiency solar cells on suitable polysilicon substrates.

SUPPORTED BY U.S. Dept. of Energy, Div. of Solar Technology

4.0026, GRAPHO-EPITAXY OF GALLIUM-ARSENIC (GAAS)

J.M. Ballantyne, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NAG 1-83)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0027, INVESTIGATION OF THE FLUCTUATION MECHANISM IN TURBULENT FLOW

V. Zakkay, New York University, School of Science & Engineering, Dept. of Aeronautics & Astronautics, *Washington Sq., New York, New York* 10003 (DF042080; AFOSR-76-2947)

AF function - advanced aerospace vehicles. Opportunity - better understanding of turbulent flows. Objective - investigate the mechanisms of pressure fluctuations in a turbulent boundary layer and influences on the turbulent structure by active and passive perturbations of the flow. How work contributes - improvement in our physical understanding of turbulent flows will result in improved design capability for advanced aerospace vehicles. A better knowledge of turbulence production could indicate possible ways to influence a fully developed turbulent flow without using additional energy. One possibility is suitably designed flexible walls. Altering the character of the turbulent flow should make it possible to reduce surface drag and turbulence-induced aerodynamic noise.

An experimental program has been established to study the change in the large scale disturbances, called 'bursts', due to introducing controlled sources of pressure fluctuations or changes in wall characteristics. An analysis will be made to determine how the changes in the turbulent structure due to these perturbations will affect overall skin friction and radiated noise. The bursting phenomena will be studied at low (50 ft/sec) speed and

at high (Mach numbers near 0.65) speed and at different boundary layer thicknesses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, SPECKLE AND MOIRE METHODS FOR EXPERIMENTAL STRESS ANALYSIS

F. Chiang, State University of New York, Stony Brook Campus, School of Engineering & Applied Science, Dept. of Mechanical Engineering, *Stony Brook, New York* 11794 (CME80-09047)

This action is for support of a three-year continuing grant, with a total commitment for three years.

A major concern in understanding and predicting the mechanical behvior of solids is the measurement of the stresses and strains in a solid. This research program continues the development of a group of laser speckle methods for measuring strains. These methods have the very desirable feature of being non-contacting, remote sensing, and non-destructive, and they can be applied to structures in situ.

In particular, the methods are being generalized to include the effects of illumination and viewing angles and the influences of parameters which affect the scattered light speckle method. This latter technique is one of the very few procedures that is capable of measuring strains in the interior of a solid. Also being studied are: (1) a group of white light speckle methods, (2) moire methods with random gratings, (3) the application of moire and speckle methods to cyclic loading and metal fatigue through time-average recording, and (4) the application of speckle methods to the dynamic ductile fracture of metals.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Civil & Mechanical Engineering

4.0029, CLOSELY COUPLED STABILIZATION CLUSTER TEST DEMONSTRATION SYSTEM

Unknown, Stencel Aero Engineering Corp., *Asheville, North Carolina* (DA0H4393; DAAK60 78 C 0092)

To determine technical feasibility of the use of a closely coupled cluster of small flat circular parachutes for improving platform pitch stability during the high speed descent stage of a high altitude platform air-drop system. If successful, this concept will be simple and less complex than other alternatives currently under investigation.

To procure a test demonstration system for actual air-drop and observation of results. A test demonstration is needed because questions relating to reliable deployment and inflation of the small cluster operating in the near-wake of the air-drop cargo can only be resolved in this fashion.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0030, AIR CYCLE COMPRESSOR-EXPANDER

R. Smolinski, Ecton Corp., *5683 Webster St., Dayton, Ohio* 45414 (DA0P3645; DAAK70 79 C 0042)

Develop an air cycle (reversed Brayton cycle) compressor-expander with a coefficient-of-performance (COP) of one (1).

Conduct an exploratory development program using the rotary vane, positive displacement air cycle compressor-expander concept with special attention to reducing internal heat transfer from the compressor to the expander - reducing blade flexing and friction at rotor plates and end-plates - increasing volumetric efficiency.

SUPPORTED BY U.S. Dept. of Defense, Army, Mobility Equipment Research & Development Command

4.0031, STUDY INVOLVING COMMUNICATIONS LINK CHARACTERIZATIONS EXPERIMENTS WITH THE COMSTAR SATELLITE

D.B. Hodge, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NASW 3393)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

4.0032, ENGINEERING SUPPORT ORGANIZATION AND MANAGEMENT

Unknown, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF318250; F33615-79-C-0500)

To provide engineering support services for in-house research under project 6893. Follow-on fiscal and narrative data for this work unit can be found under MASIS Accession Numbers 318250 and 319221.

Time and materials contract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

4.0033, GAS TURBINE ENGINE SMOKE SUPPRESSANT ADDITIVE MECHANISMS

M. Rocquemore, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF336500)

Postulate several thermochemical models to explain the smoke suppressing action of jet fuel additives such as ferrocene and delineate an experimental protocol to evaluate the proposed mechanisms.

The study will be conducted at a university through the Senior Investigator Program at the Air Force Aero Propulsion Laboratory (AFAPL). The work will be investigational only and will not involve any experimental testing. The study will result in a joint CEEDO/AFAPL TR to be published early in FY 79.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0034, INVESTIGATION OF METHODS OF PLASMA EXCITATION

M. Lake, Universal Energy Systems Inc., *Dayton, Ohio* (DF461390; F33615-77-C-3113)

AF function - communication illumination weaponry. Deficiency -lack of data on efficient methods of plasma excitation and of microscopic excitation processes. Research - experimental analysis of excitation methods and cross-sections. How research contributes -provides total ionization cross-sections and excited state cross-sections in both atomic and molecular gases. Microwave excitation provides efficient distributed discharge excitation.

The research will be conducted using three existing experimental configurations located in Bldg. 450, WPAFB. They are a cross-beam excitation analyzer (2XB), a fast Fourier transform (FFT) facility and a microwave excitation facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0035, OPTIMIZATION - STRUCTURAL ANALYSIS AND DYNAMICS

D.G. Fertis, University of Akron, School of Engineering, Dept. of Civil Engineering, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NGT 36-001-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0036, TRAINING GRANT FOR ALGORITHMS FOR NONLINEAR PROBLEMS
A.L. Simon, University of Akron, School of Engineering, Dept. of Civil Engineering, *302 E. Buchtel Ave., Akron, Ohio* 44304 (NGT 36-001-801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0037, CHARACTERIZATION OF HEAT TRANSFER IN CERAMIC-COATED INTERNAL COMBUSTION ENGINES
R.G. Murray, Oklahoma State University, School of Arts & Sciences, Dept. of Anatomy & Physiology, *Agricultural Hall, Stillwater, Oklahoma* 74075 (DA0G8962; DAAG29-79-G-0021)

To establish both an in-depth temperature profile data base and a heat transfer model so that design engineers can take full advantage of the potential benefits of insulated ceramic coatings on engine parts. Relevance - this research is directly related to current TARADCOM engine programs such as the high temperature gas turbine and the adiabatic diesel engine.

A series of engine tests is planned that will obtain a temperature profile data base which will consist of C-1 and S-1 operation over a range of fuel-air ratios and compression ratios. Data will be collected for the piston and exhaust valve with two coating thicknesses as well as for non-coated operation. Annand's mathematical model for predicting heat transfer characteristics will be modified to make it applicable for coated operations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0038, WIND TURBINE STRUCTURAL DESIGN AND ANALYSIS
R.W. Thresher, Oregon State Higher Education System, Oregon State University, School of Engineering, Dept. of Mechanical Engineering, *200 Covell Hall, Corvallis, Oregon* 97331 (NAG 3-87)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0039, THIN FILM ACOUSTOOPTIC DEVICES
C.S. Tsai, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Electrical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF046900; AFOSR-77-3187)

A function - solid-state devices are essential components of Air Force electronic countermeasures, communications and signal processing systems. Opportunity - it is now recognized that integrated/fiber optics will have important applications in wideband multichannel communication and information processing. In order to achieve applications in these areas, high-performance thin film active devices are needed, and thin film acoustooptic devices appear to be very promising for this purpose. Objective - the main objectives of this research are to investigate several thin film acoustooptical devices which have potential for application to future wideband multichannel integrated/fiber optic signal processing and communication systems. How work contributes - this effort advances optical processing for communications and information processing systems.

Several wideband multichannel acoustooptic and electrooptic devices/concepts will be investigated with regard to three application areas - very high scanning-rate light beam deflection switching, spectrum analysis of very wideband rf signals, and high speed acoustooptic read-out for integrated optic signal processing. Basic device configurations will be used to study the underlying interaction mechanisms, to establish the key design parameters/criteria, to determine the ultimate capability of the devices, and to explore unique applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0040, INTRODUCTION TO AERO-SPACE ENGINEERING
W. Williams, Lincoln University, Undergraduate School, *Lincoln University, Pennsylvania* 19352 (NCA 5-98)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0041, BLACK A-SI:H SPUTTERED FILMS FOR PHOTOVOLTAIC SOLAR CELLS
R.F. Messier, Pennsylvania State University, University Park Campus, Materials Research Lab., *Research Center, Room 212, University Park, Pennsylvania* 16802 (AC03-79ET23038)

The objective of this project is to carry out a systematic study on the preparation, characterization, and photovoltaic properties of Black a-Si:H films, prepared by rf-sputtering, so as to achieve efficient and cost-effective solar cells. To obtain this we are using the simple, potentially low cost, MIS and MS configuration on textured Black a-Si:H sputtered films. In order to fulfill these objectives, the following five tasks have been identified: (1) prepare, characterize, and optimize sputtered a-Si:H films through sputter-parameter variations including n and p dopant gases; (2) determine the H-content in a-Si:H films by the technique of sputter-induced optical emission; (3) analyze a-Si:H films in regard to composition and structure; (4) establish low reflective surface textures by chemical etching and determine to what extent the surface texture can be controlled and varied; and (5) form and evaluate MS and MIS photovoltaic structures based on above materials. During the first quarter of this contract a-Si:H has been prepared by rf-sputtering under a range of hydrogen partial pressures. The films have been etched and resulted in a similar, large reduction in reflectivity as found previously for a-Si film with no hydrogen doping. This clearly reveals the anisotropic microstructure in these hydrogenated films.

SUPPORTED BY U.S. Dept. of Energy, San Francisco Operations Office

4.0042, DONOR-TYPE GRAPHITE INTERCALATION COMPOUNDS
J.E. Fischer, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (DA0F9050; DAAG29 77 C 0040)

To determine the basic electrical conduction mechanisms of graphite intercalation compounds. Relevance - intercalated graphite compounds have been shown to exhibit unusually high electrical conductivities in the basal plane, approaching that of copper. This, coupled with lighter weight, makes these compounds interesting systems with potential for revolutionary impact in power generation and motors.

Electronic transport will be studied by conductivity, Hall coefficient, mangetoresistance, and metallic reflectance measurements from 4.2 - 300 K. Graphite will be intercalated with electron donor species including Li, K, Rb, C2 (monovalent), and Ba (divalent) and studied for several stoichiometric concentrations corresponding to varying C-axis superlattice periodicity.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0043, APPROXIMATION METHODS IN MULTIDIMENSIONAL FILTER DESIGN
N.K. Bose, University of Pittsburgh, School of Engineering, Dept. of Electrical Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (DF051090; AFOSR-78-3542)

AF function - to design optimal cost-effective digital filters for radar, image processing, and telemetry systems. Deficiency - the advantages of digital signal processing are so compelling that the Air Force as well as commercial communications companies are gradually converting all communications to digital systems. The applications requiring two or more dimensions, such as video information, still contain some technological problem areas that prevent the economic usage of similar digital techniques. Objective - to advance the theory of approximation of functions of several variables by rational functions, in order to effectively design realizable filters that closely approximate

the performance of a desired ideal performance. How work contributes - success in this research could lead to vastly improved digital circuitry for the various electronic systems used in aerospace vehicles and communications networks.

Approximation theory in one real variable makes use of the Haar condition, which does not hold in the more general situation. The plan is to study various schemes that can be devised to partly overcome this obstacle. The results of the approximation investigations will be applied to actual multidimensional filter design problems where the desired frequency response function is given.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0044, TRANSIENT AIRFLOW MEASUREMENT

S. Webofer, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF420953; F40600-77-C-0003)

The objective of this effort is to develop a method to measure engine transient airflow and to calibrate an Air Force Aero-Propulsion Laboratory (AFAPL) engine inlet bellmouth system for use in transient airflow testsing of a J85 engine.

An experimental test facility will be fabricated using a critical flow Venturi in series with a throttling plug assembly (TPA). The TPA will consist of a shrouded bullet-nose and strut assmbly and a translating variable area plug. The TPA will be calibrated for airflow rates as a function of plug position.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0045, SPACE-VARIANT OPTICAL SYSTEMS

J. Walkup, Texas Tech University, School of Engineering, Dept. of Electrical Engineering, *P.O. Box 4340, Lubbock, Texas* 79409 (DF041420; AFOSR-79-0076)

AF function - the real-time operation of the Air Force's increasingly complex weapon and command control systems will continue to require research to pursue higher throughput rates for the information processors. Opportunity - a major technology that will help meet this requirement is optical processing; however, current optical processors are limited by inflexibility in that they cannot perform nonlinear, space-variant, or computational operations. Objective - this research will explore techniques for performing one- and two-dimensional space-variant optical filtering. How work contributes - this effort advances optical processors for airborne and missile applications.

Experimental evaluations of the performances of various phase-coding diffusers will be performed, and analytical studies aimed at predicting the performances of two-dimensional systems with larger input arrays will be undertaken. The technique of computer multiplexing of individual holograms prior to generating a holographic mask for use in a two-dimensional space-variant processor will be examined. An input scanning technique for performing generalized linear coherent operations will be investigated, both analytically and experimentally. Finally, a comparison of coherent and incoherent space-variant processors of one-dimensional signals will be initiated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0046, COMPLEX TURBULENT FLOWS

L.S. Kovasznay, University of Houston, Graduate School, *3801 Cullen Blvd., Houston, Texas* 77004 (DF056490; F49620-79-C-0227)

AF function - aerospace vehicles. Deficiency - turbulent flow fields are only partially understood; the interactions between turbulent shear flows of different turbulence structures are even less understood. Objective - to increase the understanding of the interactions when two turbulent streams of different turbulent structures mix. How work contributes - increased understanding of this flow situation will aid in the design of advanced aerospace vehicles in the area of jet augmentation systems, the mixing of fuel and oxidizer streams for combustion, nozzle arrays in laser cavities, stability or decay of wakes and wake vortices, the stability of boundary layers, boundary layer separation and other.

An experimental investigation of the behavior of the large scale structures of axisymmetrical flow streams when different turbulence structures are initially present within the interacting streams will be performed. The results of these interactions will be compared to existing prediction methods of the transport properties and new modeling methods will be proposed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0047, STUDY INVOLVING SATELLITE AND TERRESTRIAL PROPAGATION MEASUREMENTS AND ANALYSIS

W. Vogel, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712 (NASW 3388)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

4.0048, INPUT FILTER COMPENSATION FOR SWITCHING REGULATORS

F.C. Lee, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Electrical Engineering, *Blacksburg, Virginia* 24061 (NAG 3-81)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0049, ENVIRONMENTAL RADIATION SAFETY, PLUTONIUM SOURCE TEAM EVALUATION

O.R. Moss, U.S. Dept. of Energy, Battelle Pacific Northwest Lab., *P.O. Box 999, Richland, Washington* 99352 (AG-40-20-04; AC06-76RL01830)

The objective of the project is to evaluate the plutonium source term in the environment in the event of a space vehicle or nuclear source accident which might result in the damage of a 238-Pu refractory oxide power source. Experiments are conducted on aerosol interaction, soil-plutonium aging, plutonium dissolution, and aerosol characterization. Particle size distributions, coagulation rates, dissolution rates, and source term are measured, calculated, and evaluated from compiled data. From the aerosol interaction experiments, a general conclusion is that coagulation of different aerosols (soil, plutonium, etc.) observed in the experimental model results in an increased safety factor (on the order of a factor of 10) over the plutonium aerosol alone. Plans are to conduct additional experiments to measure soil scattering and resuspension from impact and better quantify coagulation ratios.

SUPPORTED BY U.S. Dept. of Energy, Office of Policy & Evaluation, Office of Nuclear Energy

4.0050, RESONANCE IN WEAKLY NONLINEAR SYSTEMS

J. Kevorkian, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF055900; F49620-79-C-0141)

AF function - aerospace vehicle stability. Opportunity - useful approximate analytic solution of certain nonlinear equations of motion seem attainable. Objective - a parametric understanding of phenomena involving resonance in weakly nonlinear systems. How work contributes -by improving design techniques.

The technique of multiple time (or space) scales, originated by Professor Kevorkian, is one of the most powerful ways to obtain uniform asymptotic expansions of differential and integral equations. It involves introducing slow- and fast-time variables to obtain a hierarchy of simpler equations for the expansion coefficients. It is proposed to attempt to extend the applicability of this technique to resonance phenomena for weakly nonlinear ordinary and partial differential systems with slowly varying parameters. Conditions for sustained resonance and the change in

value of an adiabatic invariant cross-resonance are examples of topics to be considered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, INVESTIGATIONS OF MAGNETIC FIELD PULSATIONS DETECTED AT VOSTOK, ANTARCTICA
R.R. Heacock, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (DPP79-00882)

The induction magnetometer system at Vostok, Antarctica, is to be operated through the remainder of 1979, the final year of the International Magnetospheric Study, and analysis of the data taken at Vostok last year will be continued.

Problems to be investigated include the rotation of the hydromagnetic wave vector as the wave passes through the ionosphere to the ground, the study of wave characteristics in the magnetosphere and at the ground versus shocks and discontinuities in the interplanetary medium, and the study of wave propagation in the polar cap ionosphere with emphasis on propagation through the dayside cusp of the ionosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0002, STREAM CORRIDOR PHYSIOGRAPHY OF THE SUSITNA RIVER BASIN, ALASKA
W. Stringer, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (NCA 2-20001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0003, DESERTIFICATION IN THE NORTHERN SAHARA
G. Wendler, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM79-15798)

Causes of desertification in the Tunisian portion of the Northern Sahara will be investigated. Emphasis will be placed on the effects of overgrazing on surface radiative properties. Radiation measurements by ERTS (LANDSAT) satellite will be correlated with on-site observations of land use. Radiation differences between protected and overgrazed areas will in turn be correlated with precipitation, evaporation, and atmospheric circulation patterns for the two kinds of areas. In this way, the impact of overgrazing on desertification processes will be determined. These results will not only be of interest to the atmospheric sciences community but will also have profound implications about the contribution of marginal climatic areas to the world food supply.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0004, APPLICATION OF AIRBORNE REMOTE SENSING TO PROBLEMS CAUSED BY INCREASED VOLCANIC HEAT FLUX OF MT. WRANGELL
C.S. Benson, University of Alaska, Fairbanks Campus, School of Environmental Sciences, Dept. of Geophysics & Geology, *Fairbanks, Alaska* 99701 (NAG 9-9)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0005, STRATOSPHERIC-MESOSPHERIC MODELS
C.A. Riegel, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCA 2-675007)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0006, FUNDAMENTAL COMBUSTION RESEARCH APPLIED TO POLLUTION CONTROL
T.J. Tyson, Energy & Environmental Research Corp., *8001 Irvine Blvd., Santa Ana, California* 92705 (68-02-2631; FC2L - 801400)

OBJECTIVE: To formulate and carry out a three-year program of research designed to provide such basic understanding of combustion phenomena as is required to achieve the EPA's goals for the reduction of NOX emission from stationary sources. Studies will be conducted in the following five areas: (1) NOX formation in simple gaseous systems, (2) transport phenomena in combustion systems, (3) chemistry and physics of two-phase systems, (4) analytical and process design-tool development and (5) measurement systems.

APPROACH: Expand fundamental knowledge of mechanisms (chemical and aerodynamic) controlling pollution formation in flames. End-items will be used by developers of combustion modification technology.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

5.0007, SEASAT PROGRAM - STATISTICAL INTERPRETATION OF SEASAT ALTIMETER DATA
B.J. Lipa, S R I International, Remote Measurements Laboratory, *333 Ravenswood Ave., Menlo Park, California* 94025 (7-923; MO-AO1-78-00-4319 MOD #2)

OBJECTIVE: Develop integral inversion techniques for estimation of ocean wave parameters from SEASAT altimeter data, and determine statistical uncertainties associated with these parameters.

APPROACH: SEASAT altimeter data taken during the Gulf of Alaska (GOASEX) experiment and the Joint Air-Sea Interaction (JASIN) experiment will be compared to ocean wave data observed with ocean data buoys.

CURRENT PLANS: Altimeter data for JASIN and GOASEX areas will be analyzed to determine the covariance matrix of the leading edge of the returned altimeter echo. Ocean surface wave parameters and their uncertainties will be determined using maximum likelihood and integral inversion methods and compared to data taken with ocean data buoys.

PROGRESS: A model has been developed that gives the form of the leading edge produced by radar scatter from a patch of ocean that has both long-period swell and wind-generated waves. A method has also been developed to give parameters of the ocean surface wave height probability density by using the inversion of the integral equation for the slope of the leading edge.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0008, THEORETICAL STUDIES OF THE PLASMA ENVIRONMENTS OF JUPITER AND SATURN, THEIR MAGNETOSPHERES AND THEIR SATELLITES
G.L. Siscoe, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Meteorology, *405 Hilgard Ave., Los Angeles, California* 90024 (NAGW 87)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0009, SOLAR TERRESTRIAL OBSERVATORY SCIENCE STUDY GROUP
R.C. Canfield, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (NAS 8-33795)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0010, COASTAL ZONE SCANNER VALIDATION STUDIES
R.W. Austin, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (NAS 5-26249)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0011, SCIENTIFIC AND APPLICATIONS INVESTIGATIONS OF STRATOSPHERIC TRACE GASES
R.J. Cicerone, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (NAG 1-77)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0012, APPLICATION OF SATELLITE FREEZE FORECAST TECHNOLOGY TO OTHER PARTS OF THE US, PHASE II
J.D. Martsolf, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Astronomy, *208 Tigert Hall, Gainesville, Florida* 32601 (NAS10-9876)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

5.0013, SATELLITE FREEZE FORECAST SYSTEM PHASE IV
J.D. Martsolf, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Astronomy, *208 Tigert Hall, Gainesville, Florida* 32601 (NAS10-9892)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

5.0014, EVOLUTION AND BEHAVIOR OF MAJOR POLUTION EPISODES OVER EXTENDED TIME AND SPACE SCALES
J.M. Prospero, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (NAS 5-26241)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0015, THE PHOTOCHEMISTRY OF TROPOSPHERIC CARBON-OXYGEN (CO) AND NITROGEN-OXYGEN (NO) AND THE IMPACT OF ANTHROPOGENIC EMISSIONS
W.L. Chameides, Georgia Inst. of Technology, School of Physics, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAG 1-85)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0016, USER SUPPORT AND DATA REDUCTION AND ANALYSIS OF LUNAR CORE IMAGES
T.B. McCord, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (NAGW 37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0017, STUDIES IN PROBABILITY FORECASTING AND THE VALUE OF WEATHER FORECASTING
R.L. Winkler, Indiana University, Indiana University - Purdue University at Indianapolis, School of Business, Dept. of Quantitative Business Analysis, *1121 W. Michigan, Indianapolis, Indiana* 46202 (ATM77-24060)

The objectives of this research are to investigate probability forecasting in meteorology and to study the value of weather information in the context of weather-related decision-making problems. The research will include the development of new methods through the use of experiments, surveys, specific meteorological applications, and other types of studies. The research program in the area of probability forecasting in meteorology consists of three types of studies: experimental studies, methodological studies, and surveys. The research program in the area of the value of weather information includes two types of studies: specific applications and methodological studies. These results are important for probability forecasting in meteorology, implications for probability forecasting and decision-making in general, and specific implications for the particular meteorological situations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0018, THE MAGNETIC FIELD OF JUPITER
D.B. Beard, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Physics & Astronomy, *112 Bailey Hall, Lawrence, Kansas* 66045 (NAGW 71)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0019, EQUIPMENT REQUEST FOR PHYSICAL GEOGRAPHY RESEARCH LABORATORY FACILITIES
W.C. Johnson, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Geography Meteorology, *112 Bailey Hall, Lawrence, Kansas* 66045 (SES79-23693)

This equipment will be used to expand existing physical geography laboratory facilities into an integrated facility by supplementing existing equipment and replacing inadequate and undependable equipment. The equipment will be used to expand university research in the areas of environmental change and human impact on the environment. Specific projects currently in progress and planned for the future deal with: (1) the cultural ecology of the prehispanic Maya in Honduras, (2) the dendroclimatology of western Honduras, (3) Mayan raised-field agriculture, (4) historical changes in the stream systems of the central U.S., (5) post-glacial river response to environmental change, (6) post-glacial fluctuation in Arctic tree lines, (7) paleosols and paleoenvironments of the south-central U.S., (8) soil modification by the prairie ant, (9) shelterbelt disappearance in the Great Plains, (10) pine beetle infestation in the Front Range, Colorado, (11) Musk Thistle spread in Kansas, (12) irrigation and water resources in western Kansas, (13) spectral responses of urban and agricultural landscapes, (14) remote-sensing of archaeological sites in Kansas, and (15) water quality-drought relations in Kansas.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Social & Economic Science

5.0020, RESEARCH RELATIVE TO LASER AND STAR TRACKING ON GSFC TELESCOPES
D.G. Currie, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAG 5-90)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0021, A SURVEY OF TRACE METAL POLLUTION IN THE LOWER EASTERN SHORE AREA
Y.W. Hung, University of Maryland, Eastern Shore, Undergraduate School, Dept. of Natural Sciences, *Princess Anne, Maryland* 21853 (NAG 6-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0022, AURORAL OPTICAL STUDY
R.H. Eather, Keo Consultants, *Newton, Massachusetts* (DF248640; F19628-77-C-0097)

AF function - communications and detection. Deficiency - understanding effects both of precipitating particle and non-particle produced ionospheric disturbances which degrade communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by means of auroral spectral emission features measured with a sensitive T.V. system. How research contributes -provides a new and powerful technique for large-scale and high time resolution auroral measurements. Coordination with other simultaneous measurements from the AFGL Airborne Ionospheric Observatory, NKC-135 aircraft, will allow comprehensive measurements of ionospheric response to substorms over sub-auroral, auroral and polar cap domains.

Perform comprehensive investigation of the latitude and local time behavior of large scale ionospheric disturbance phenomena resulting from auroral particle precipitation in the vicinity of the auroral oval. This investigation will be based primarily on ground and airborne all-sky imaging photometer, all-sky camera and meridian scanning photometer auroral measurements. Investigate the dynamic properties of the equatorial F-region and the formation of ionospheric irregularities through associated airglow signatures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, THE ROLE OF VEGETATION IN THE WATER BALANCE OF A LANDSURFACE
P.S. Eagleson, Massachusetts Inst. of Technology, School of Engineering, Dept. of Civil Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-89)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0024, SATELLITE DATA REDUCTION ANALYSIS AND STUDIES
R.W. Fioretti, R D P Inc., *Waltham, Massachusetts* 02154 (DF580540; F19628-78-C-0226)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of atmospheric density by satellite-borne accelerometers. Correlation of these results is made with coordinated experiments and solar and geophysical parameters to develop improved atmospheric models. How research contributes - permits development of accurate density forecasting techniques.

A mesa accelerometer was flown on each of three atmosphere explorer satellites. High accuracy, high resolution density data are obtained from this experiment. Telemetry data from this experiment, the EUVS experiment, and other coordinated aeronomical measurements are stored in a Sigma 9 computer at NASA/GSFC. Data are processed and accessed using a remote terminal at AFGL. Studies are to be performed to improve knowledge of atmospheric variability. Density, composition and temperature measurements will be analyzed to develop more accurate models of the geomagnetic activity effect. Also, variations related to solar radiation, latitude and local time will be investigated to provide empirical models of the neutral atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, SATELLITE ACCELEROMETER DATA STUDIES
R.W. Fioretti, R D P Inc., *Waltham, Massachusetts* 02154 (DF582740; F19628-79-C-0117)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of atmospheric density by satellite-borne accelerometers. Correlation of these results is made with other satellite data and with solar-geophysical parameters to develop improved atmospheric models. How research contributes - permits accurate determination of Air Force satellite ephemerides and development of accurate density forecasting techniques.

A SETA (satellite electrostatic triaxial accelerometer) is to be flown on each of four Air Force satellites. This instrument permits high accuracy, high resolution aerodynamic drag measurements in three orthogonal axes. Atmospheric density is directly proportional to drag. Cross-axis winds will also be determined. Telemetry data from each flight will be provided on tape. The data will contain accelerations due to vehicle dynamics in addition to the drag data. Techniques such as digital filtering will be used to accurately determine the atmospheric density. In addition, studies will be performed to investigate density and wind variations related to latitude, longitude, geomagnetic activity, local time and solar flux. These studies will result in the development of accurate atmospheric models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, DESIGN OF AEROSPACE EXPERIMENTAL INSTRUMENTS
J. Otis, Wentworth Inst. of Technology, Undergraduate School, *550 Huntington Ave., Boston, Massachusetts* 02115 (DF580010; F19628-78-C-0017)

AF function - military operations of the B-1, F-15 and other AF vehicles in the stratosphere, nuclear weapons delivery, communications, detection, track, and intercept. Deficiency - environmental effects of AF stratospheric operations cannot be predicted because of a lack of stratospheric data. Further, mixing and chemical effects of jet engine or missile effluents are only poorly defined. Also, inability to forecast upper atmosphere interactions affecting the design and operation of military systems such as reentry vehicles, over-the-horizon radar, polar communications and satellite ephemerides. Research -design, test and provide quadrupole mass spectrometers and gas sampling hardware with associated support equipment to be used in rocket and balloon-borne experiments. Cryogenic, vacuum, and contaminant-free technologies are used. How research contributes - establish stratospheric standards and criteria by period in situ and laboratory gas analysis and provide data for upper atmospheric assessment models by measurement of neutral and ionized species.

Consultation between experimenters and mechanical designers to include review of mechanical designs and monitoring the fabrication, delivery of prototype instruments, testing in-flight configurations, design and updates, if necessary. Designers may be required to operate instruments during field experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, AEROSPACE PAYLOAD RESEARCH AND DEVELOPMENT
J.M. Otis, Wentworth Inst. of Technology, Undergraduate School, *550 Huntington Ave., Boston, Massachusetts* 02115 (DF247640; F19628-76-C-0211)

AF function - reconnaissance, surveillance, communication and advanced weapon systems. Deficiency or opportunity - inability to forecast atmospheric interactions affecting the design and operation of military systems such as reentry vehicles, over-the-horizon radar and satellite operations. Objectives - (a) to perform research and engineering as required in the design, fabrication and test of aerospace payloads and GSE sensors; (b) to redesign, fabricate, test and evaluate component assemblies of existing aerospace vehicles for the purpose of improving reliability and/or cost-effectiveness. How research contributes - the complexities of upper atmosphere and near-space in situ mea-

surements demand state-of-the-art expertise if meaningful data are to be retrieved. Improved construction techniques and designs can only enhance reliability of experiments directly related to AFGL projects 2310, 6688, 6690, 7659, 7661, 7670, 8658 and SAMSO program 2127.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, AERIAL APPLICATIONS RESEARCH PROGRAM
Unknown, Delta College, Undergraduate School, *University Center, Michigan* 48710 (NCA 1-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0029, SATELLITE/SPACE-PLASMA INTERACTION STUDY
U. Samir, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical & Computer Engineering, *Ann Arbor, Michigan* 48104 (DF582420; F19628-79-C-0060)

AF function - communication, navigation, command and control. Objective - to determine the structure of the plasma sheath and wake in the vicinity of a satellite and to perform a parameter study relating satellite velocity, altitude, ambient plasma density, temperature and energy. Examine effect of spacecraft-induced plasma oscillations on the reliability of in situ plasma measurements from spacecraft. Develop an empirical model of the sheath structure for the low altitude satellites DMSP, S3-2, S3-3, Space Shuttle (STS) and the synchronous orbit AF satellite, SCATHA. How research contributes - defines and quantifies spacecraft sheath and charging properties enabling the effects on communications equipment and electrical and optical sensing systems to be evaluated.

A parametric study of problems involved in spacecraft/space-plasma interactions at low altitude utilizing in situ measurements made aboard Air Force satellites including the S3-2, S3-3 and DMSP will be made. Use results from the study to set up a definite experiment using Space Shuttle which will study plasma interactions with experimental bodies under closely monitored conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, OBSERVATION AND SUGGESTIONS FOR EXPERIMENTAL SET-UP AND MEASUREMENTS ON JET NOISE REDUCTION
Unknown, New York University, Graduate School, *100 Washington Sq. E., New York, New York* 10003 (NCA 1-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0031, SEASAT PROGRAM - USE OF RADAR ALTIMETER CROSS-SECTION MEASUREMENTS TO INFER OCEAN SURFACE WIND SPEEDS AND ICE CHARACTERISTICS
G.S. Brown, Applied Science Associates Inc., *105 E. Chatham St., Apex, North Carolina* 27502 (K7-938; NA79SAC00723 MOD.#1)

OBJECTIVE: Improve and expand techniques for estimation of surface wind speeds from analysis of SEASAT radar altimeter's measurement of the surface scattering cross-section over the open ocean.

APPROACH: Compare SEASAT altimeter-derived wind speeds to wind speeds observed at NOAA data buoys and hurricane wind speeds observed by aircraft. Test relationships derived from GEOS-3 satellite altimeter which also relates scattering cross-section to wind speed, and develop improved scattering cross-section-to-wind speed relationships for the SEASAT altimeter, particularly at strong wind conditions.

CURRENT PLANS: In addition to surface truth data available from NOAA data buoys, high quality surface truth data are also available from the GOASEX experiment, the South Atlantic/Pacific Storms Workshop, the Grand Banks experiment, and Canadian aircraft flights over ice. Altimeter calibration measurements will be accomplished by comparison to the SEASAT scatterometer measurements, particularly at high wind speeds. Analysis of scattering data over ice will be started.

PROGRESS: GOASEX data, along with limited buoy overflight data, have demonstrated the wind measuring capability of the altimeter for wind speeds up to 10 m/s. Comparisons between SEASAT and GEOS-3 have resulted in a 1.6 db correction thus far. Co-author of paper given at National Radio Science Meeting, Boulder CO, November 5-8, 1979: 'An Intercomparison of the Wind Measuring Instruments on SEASAT.'

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0032, CHEMICAL ANALYSIS OF VEGETATION SAMPLES
C.B. Smith, Pennsylvania State University, University Park Campus, School of Agriculture, Dept. of Horticulture, *201 Ag. Admin. Bldg., University Park, Pennsylvania* 16802 (NAS 5-26215)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0033, SYNTHESIS OF REGIONAL CRUST AND UPPER MANTLE STRUCTURE FROM SEISMIC AND GRAVITY DATA
S.S. Alexander, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Geosciences, *116 Deike Bldg., University Park, Pennsylvania* 16802 (NAG 5-77)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0034, APPLICATION OF SATELLITE DATA TO STUDY EFFECT OF LATENT HEAT RELEASE ON CYCLONE
J.H. Clark, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (NAS 8-33797)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0035, REMOTE SENSING INFORMATION APPLIED TO GEOLOGICAL STUDIES OF PLANETS
J.W. Head, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NAGW 28)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0036, PROPOSED WORK ON THE OSTA, RIO GRANDE RIFT PROJECT
M.A. Dungan, Southern Methodist University, School of Humanities & Sciences, Dept. of Geological Sciences, *Hillcrest & University, Dallas, Texas* 75222 (NAS 9-16140)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0037, ALTITUDE-DEPENDENCE OF SPACECRAFT CHARGING
Unknown, U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center, *Houston, Texas* 77058 (DF585170)

AF function - surveillance, communications, utilizing satellites. Deficiency - satellites are degraded by electrical charge-up induced by the plasma environment. Objective - to determine the variation of spacecraft charging and space plasma as a function of altitude. How research contributes - knowledge of the altitude characteristics of charging will allow an assessment of the importance of spacecraft charging in affecting the overall AF mission in space. It will allow an extension of knowledge gained at geosynchronous orbit to other altitudes.

Data from various satellites available to the NASA Johnson Space Center will be analyzed in order to determine the level of spacecraft charging and corresponding plasma conditions as a function of satellite altitude. Statistics will be gathered on the percentage of occurrence of various potentials at different satellite locations and of the associated plasma conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0038, LOWER THERMOSPHERE WINDS
W.B. Hanson, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (DF583600; F19628-79-C-0113)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of neutral wind motions by satellite-borne accelerometers. Correlation of these results is made with other satellite data, including accelerometer density measurements, to develop improved atmospheric models. How research contributes - permits accurate determination of Air Force satellite ephemerides and development of accurate density forecasting techniques.

A satellite triaxial accelerometer system was flown on the Atmosphere Explorer-C satellite. Atmospheric density measurements have been derived from the two axes oriented to see large components of the force due to air drag. The third accelerometer axis was always nearly perpendicular to the air drag direction. Forces due to atmospheric winds along this axis may be determined. Separation of wind data from other forces acting on this axis is required. The other forces include those due to vehicle dynamics, motions of other instruments on the satellite and a small component of air drag if the accelerometer axis is not exactly orthogonal to the drag vector. This study will determine the accuracy with which neutral winds can be measured as a function of satellite altitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0039, GEOPHYSICAL STUDEIS OF THE RIO GRANDE RIFT
G.R. Keller, University of Texas, El Paso Campus, School of Science, Dept. of Geological Sciences, *El Paso, Texas* 79902 (NAS 9-16142)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0040, IDENTIFYING ENVIRONMENTAL FEATURES FOR LAND MANAGEMENT DECISIONS
W.O. Ursenbach, Utah Higher Education System, University of Utah, School of Science, Dept. of Chemistry, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NAGW 95)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0041, WATER QUALITY LABORATORY FOR CHESAPEAKE BAY AND ITS TRIBUTARIES AT HAMPTON INSTITUTE
T.L. Cheung, Hampton Inst., Graduate School, Dept. of Physical Sciences, *Hampton, Virginia* 23368 (R806229; QC29 -Q145)

OBJECTIVE: This study will evaluate a helicopter sampling system for applicability to wide area Bay sampling schedule which will coincide with TELSAT pass-over for water truth comparison with the satellite data. The study will also determine the economics of helicopter sampling versus boat sampling.

APPROACH: Program modeling requirements will guide the selection of locations for water samples. The helicopter-borne water quality monitoring system will record depth, pH, conductivity/salinity, temperature and dissolved oxygen. Those measurements will be compared with LANDSAT observations made during selected overpasses. The resulting data will be compared for accuracy and will be used in evaluating physical, biological and oxygen-related parameters, as well as concentration of toxicants and levels of nutrients.

SUPPORTED BY U.S. Environmental Protection Agency

5.0042, A DEMONSTRATION PROJECT TO DETERMINE THE USEFULNESS OF LANDSAT DATA TO VIRGINIA'S REGIONAL LAND USE PLANNING & RESOURCE MANAGEMENT PROGRAMS
J. Munday, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (NAS 5-26199)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0043, RESEARCH STUDY - THEORY OF GLOBAL LIGHTNING AS SEEN FROM A SATELLITE
J.T. Ely, University of Washington, School of Arts & Sciences, Dept. of Geophysics, *Seattle, Washington* 98105 (NAS 8-33884)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0044, EXTRATROPICAL CYCLONIC STORMS - THE CYCLES PROJECT
P.V. Hobbs, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (DF047280; F49620-77-C-0057)

AF function - the Minuteman and ABRES programs require hydrometer information. The AWS also requires droplet information to parameterize energy and water budgets in numerical weather prediction. Deficiency -rainfall statistics, droplet sizes and spatial distribution. Objective - the focus of effort will be narrowed during FY79, 80. The principal effort will be to measure drop and crystal sizes within the six different types of mesoscale rainbands within cyclonic storms. The microphysics will be interpreted in terms of associated meso- and synoptic scale observations. Contribution - provide hydrometer size, number density climatologies for Pacific storms. This, plus the AFGL measurements over Kwajalein Island and the US will provide both system design criteria for missile nose-cones and helicopter rotors, and data for laser and microwave attenuation studies.

Either an Electra or a P-3 aircraft will replace the present aircraft to permit aircraft penetrations into areas of heavy icing. The replacement aircraft and the Univ. of Washington's B-23 will carry full arrays of 1-D and 2-D particle measurement systems to acquire data on hydrometers as part of NSF field programs to investigate large cloud systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0045, PARTIALLY SCANNED INTERFEROMETER SOUNDING TECHNIQUE
W.L. Smith, University of Wisconsin, Madison Campus, Graduate School, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 5-26142)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0046, RESOLUTION STUDIES AND ENERGY DIAGNOSTICS OF GLOBAL DATA AND CLIMATE MODEL SIMULATIONS
D.R. Johnson, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAG 5-81)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0047, PREPARATION OF A COMPOSITE SURFACE STRESS DATA SET FOR THE SUMMER PHASE OF MONEX
V.E. Suomi, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (ATM79-13097)

The objective of this research is to map wind-induced sea-surface stresses from a composite of different satellite data sources during the Summer 1979 observing period of the Monsoon Experiment (MONEX). MONEX is a regional subprogram of the Global Atmospheric Research Program (GARP). It is a major study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions.

One of the important, but poorly understood, aspects of the monsoon is the relationship between the surface currents in the Indian Ocean and the low level Somali jet stream and its associated southwest monsoon winds.

The Indian Ocean, and the Arabian Sea and the Bay of Bengal to its north, are the moisture sources for the summer Asian monsoon rains. The surface winds over these waters are critical in determining how much moisture and heat is transferred from ocean to atmosphere. In addition, the surface winds are principally responsible for the mechanical and thermal structure of the ocean surface currents.

By using satellite-derived cloud motion wind vectors, this study will provide a description of the atmospheric winds that force Indian Ocean surface currents.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0048, THE OPTICAL SPECTRA OF ATMOSPHERIC AEROSOLS

F. Borghese, Universita degli Studi di Messina, *Via Tommaso Cannizzaro, Messina, Italy* (DA0D9456; DAERO 78 G0106)

To develop a method of calculating the imaginary part of the complex refractive indexes of atmospheric aerosols on the basis of quantum mechanics. This will make it possible to predict the absorption, polarization, and scattering properties of particulates in the atmosphere, knowing only the chemical species.

Based on a description of particulates including the transition probability in a crystal of known composition, joint density of states, critical points, and the complex dielectric functions, cooperation will be maintained with the Chemical Systems Laboratory, APG.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

5.0049, BINARY POSITIVE ION-NEGATIVE ION MUTUAL NEUTRALIZATION REACTIONS

D. Smith, University of Birmingham, *P.O. Box 363, Birmingham, England, United Kingdom* (DF249420; AFOSR-77-3260)

AF function - nuclear weapons effects, nuclear delivery. Deficiency - the effects of atmospheric nuclear detonations upon electromagnetic wave propagation cannot be accurately predicted. Objective - to measure rate constants for positive ion-negative ion mutual neutralization reactions involving atmospheric species at thermal energies. How research contributes - provides information required in computer models used to predict the effects of atmospheric nuclear detonations upon electromagnetic wave propagation.

Rate constants for binary and ternary ion-ion mutual neutralization reactions are measured using a flowing afterglow system under conditions for which the ions are energy-relaxed. The ion temperatures range from 200 to 600 K. Emphasis is on reactions of cluster ions important in the atmosphere and on the identification of products of ion-ion neutralization.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RESEARCH OF VISUAL PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION

R.W. Wiley, U.S. Dept. of Defense, Army, Medical Research & Development Command, Bio-Optics Div., *Fort Rucker, Ozark, Alabama* 36362 (DA0B6891)

To provide information about the visual sensory modality relating to capability of the human visual system and the impact of military equipment, environmental and operational influences on visual performance and integrity.

The approach will include psychophysical, electrophysiological, and other objective techniques to evaluate human visual performance with quantitative measures.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, DEVELOPMENT OF PERFORMANCE CRITERIA FOR LANDING SIGNAL OFFICERS (LSOS)

C.A. Brictson, Dunlap & Associates Inc., Wester Division, *La Jolla, California* 92037 (DN894024; N61339-78-C-0123)

LSO job performance and training standards, and measures of LSO performance variability will be developed.

A systematic, analytic approach will derive measurable LSO performance criteria describing in quantitative terms the relative effectiveness of the LSO. By relating criterion measures to LSO aircraft recovery functions, job-relevant measures with inherent face validity will be provided.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0003, MAN/MACHINE INTERFACE MODEL

H.R. Jex, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF325150; F33615-79-C-0519)

Vibration environments encountered in some aircraft mission profiles can seriously degrade the performance of essential aircrew tasks. The amount of degradation in performance is influenced by the manner in which the crewman is interfaced with his controls and displays. The objective of this contract is to provide designers with the tools for optimally selecting seatback angles, display viewing angles and distance, arm rest and control stick arrangements, and other interface variables so as to minimize the deleterious effects of vibration on task performance such as tracking and aiming.

The approach under this contract is to utilize computer modeling and display techniques to determine what would otherwise require expensive and time consuming experimentation with a variety of cockpit mock-up configurations on complex vibration facilities. The contractor will deliver a user-oriented computer programming package that will demonstrate such interface optimization methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0004, STRUCTURE AND FUNCTION OF ISOZYMES - EVOLUTIONARY ASPECTS AND ROLE OF OXYGEN IN EUKARYOTIC ORGANISMS

T. Satyanarayana, University of San Francisco, School of Science, Dept. of Chemistry, *2130 Fulton, San Francisco, California* 94117 (NCC 2-85)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, LIFE-SPANS OF SKIN FIBROBLASTS FROM IRRADIATED PRIMATES

J.T. Lett, Colorado State University, College of Veterinary Medicine & Biomedical Sciences, Dept. of Radiology & Radiation Biology, *Fort Collins, Colorado* 80523 (NAG 9-10)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0006, IDENTIFICATION OF HUMAN BRAIN WAVE PATTERNS ASSOCIATED WITH COGNITIVE AND PERFORMANCE EVENTS IN OPERATIONAL SETTINGS (ABBREV)

E. Donchin, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Psychology, *Urbana, Illinois* 61801 (DN675068; N00014-76-C-0002)

The overall objective is to attempt to determine and identify human brain wave patterns associated with (1) particular stimuli; (2) cognitive events in a learning situation; and (3) performance events in a simulated aircraft cockpit. Such information could provide a basis for improving human performance in decision-making and man-machine communication.

Experiments will continue on: (1) further elucidation of the event related potential (ERP) vocabulary, e.g., stability of P300/expectancy relationships, ERP differences between target and non target stimuli; (2) biocybernetic tests in the cockpit environment, e.g., effects of turbulence-imposed work load on processing during simulated landing; and (3) development of a closed loop biocybernetic channel, i.e., one in which some parameter of the ERP is used by the controlling computer to modify system operating parameters, e.g., measures of work load, task sharing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0007, BEHAVIORAL MODIFICATION AS AN APPROACH TO WEIGHT CONTROL IN THE AIR FORCE

O. Maller, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0H4365)

To develop an effective, integrated, individualized and prototypic program for the self attainment and maintenance of military standards of body weight for AF flying personnel. This program will make available to personnel those techniques which have demonstrated to be effective in the self-management of food habits and physical activity patterns.

Quantify and measure food selection and consumption patterns, and physical activity patterns of target population before and following the introduction of weight loss and maintenance programs. The techniques of behavior modification will be evaluated and then selected on the basis of the efficacy for individualized use to attain and maintain body weight standards of the Air Force.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

6.0008, DETECTION, RECOGNITION, AND IDENTIFICATION OF TARGETS IN CIG DISPLAYS

M. Lemay, Montclair State College, School of Science & Mathematics, Dept. of Psychology, *Upper Montclair, New Jersey* 07043 (DF054920; AFOSR-79-0103)

AF function - this research supports the Air Force Flying Training Program, particularly simulator design efforts for electrooptical display training. Deficiency - new generation flight simulators are being equipped with computer image generation (CIG) displays designed to simulate electrooptical cockpit displays (infrared and low light level TV). Because CIG systems lack adequate capacity to reproduce all real-world cues, it is necessary to know what to simulate to achieve effective training. The amount of display complexity needed to achieve this result is unknown. Objective - this research will attempt to determine the amount of display complexity needed to train three basic tasks using electrooptical displays: detection, recognition and identification of objects on the ground. How research contributes - the results of this research will add information to the knowledge base concerned with CIG simulation of electrooptical displays. It will impact the design of such simulations.

Three experiments will be conducted to estimate the minimum amount of display complexity necessary to perform detection, recognition, and identification of ground targets. Targets will be imbedded in a CIG scene created by scientists at AFHRL/AS, Wright-Patterson AFB, Ohio. The main independent variable will be the complexity of the scene. Targets will include a hangar, storage tank, water tower, house, office building and aircraft on the ground.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, INVESTIGATION OF NUCLEIC ACID INTERACTION WITH ACTIVATED AMINO ACIDS IN AMINO ACID POLYMERIZATION

G.H. Loew, Rockefeller University, Lab. of Genetics, *66th & York Ave., New York, New York* 10021 (NCA 2-630001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, SYNCHRONIZATION OF PRIMATE CIRCADIAN RHYTHMS IN SPACE

F.M. Sulzman, State University of New York, Binghamton Campus, School of Arts & Sciences, Dept. of Biological Sciences, *Vestal Parkway, Binghamton, New York* 13901 (NAS 2-10621)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0011, A STUDY OF THE MECHANISM OF THIGMOMORPHOGENESIS IN PLANTS

M.J. Jaffe, Wake Forest University, School of Arts & Sciences, Dept. of Biology, *Reynolda Station, Winston Salem, North Carolina* 27109 (NAGW 96)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0012, PRENATAL AND POSTNATAL DEVELOPMENT AND FUNCTIONAL DIFFERENTIATION OF THE VESTIBULAR SYSTEM IN NORMAL, ROTATED AND CENTRIFIGUED RATS AND MICE

J.R. Keefe, Case Western Reserve University, School of Science, Dept. of Biology, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (NAGW 83)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0013, STEADY-STATE EVOKED RESPONSES AS MEASURES OF TRACKING DIFFICULTY

G.F. Wilson, Wittenberg University, Graduate School, Dept. of Psychology, *Springfield, Ohio* 45501 (DF055270; F49620-79-C-0156)

AF function - the assessment of human operator work load is critical to the design and efficient operation of contemporary and advanced Air Force systems. Deficiency - traditionally, behavioral measures have been used to gauge the effectiveness of a design or the degree of difficulty of a task. Such measurements, however, often interfere with the task or adds to the work load of the operator. A method of work load assessment which does not itself add to the task difficulty and which can be used in operational settings is needed. Recent advances in human electrophysiology may be useful in overcoming some of the disadvantages of behavioral measures in assessing work load. Objective - the research will develop a methodology utilizing average evoked potentials (AEPs) applicable to operational situations. How research contributes - success of the proposed work effort will permit the non-invasive assessment of certain kinds of operator work load at both design and operational stages of Air Force display and control systems.

The effects of high frequency stimuli on steady-state AEPs will be tested in a situation involving a cognitive task related to operational tasks (visual tracking) to provide a critical test of the utility of this approach in operational settings for assessment of central involvement in such tasks and the level of operator work load.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0014, CARDIAC CHANGES DURING EXERCISE CONDITIONING AND ACCELERATION
H.L. Stone, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiology & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (DF050410; AFOSR-78-3506)

AF function - aircrew personnel operating high performance aircraft are exposed to increasing levels of rapid onset, sustained, repetitive maneuvering forces. It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance and severely limit or restrict the capabilities of the aircrew. Deficiency - with the development and deployment of high performance aircraft, flight personnel may be exposed to sustained periods of acceleration stress. Sustained plus-Gz acceleration has been shown to produce marked changes in human cardiac performance characterized by various arrhythmias and ECG abnormalities. These responses have been interpreted as suggesting possible hypoxic or ischemic insult to the myocardium. The miniature swine has been proposed as an animal model having similar cardiac anatomy to that of humans and, for this reason, has been used in experimental studies designed to determine the effects of acceleration stress on the heart. Objective -the overall goal of the proposed work is to define the cardiac responses of miniature swine to the high sustained plus-Gz acceleration levels which will be encountered by man in high performance aircraft during combat maneuvers. The major thrust of the current research is to identify the factor or factors leading to the cardiac responses previously observed in acceleration-stressed miniature swine. More specifically, the relative contributions of physiological factors (sympathetic nervous system) and/or mechanical stresses associated with plus-Gz acceleration will be determined. How research contributes - the research is in direct support of RO 1.6, 'habital crew environments in AF operations' and supplements ongoing projects at AMD.

After exercise conditioning and left stellate ganglionectomy, acceleration will be imposed to determine whether those responses previously observed in acceleration-stressed swine can be prevented or reduced in magnitude. Cardiac responses will be evaluated on the basis of physiological, biochemical, and histological changes. The measurement of cardiac function, indices of myocardial metabolism, coronary blood flow, and serum enzyme levels will provide information regarding the physiological status of the myocardium during acceleration stress. Long-term effects of repeated exposure to high sustained TS made in cardiac tissue.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0015, OPERATION AND MAINTENANCE OF USAFSAM CENTRIFUGE, PATHOPHYSIOLOGY OF PLUS-GZ
R.W. Thompson, Technology Inc., *8531 N. New Braunfels Ave., San Antonio, Texas* 78217 (DF324050; F33615-78-C-0618)

This effort has several objectives including (a) operation and maintenance of the USAFSAM human centrifuge, (b) test g sensitivity of selected items of life support/electronic physiological sensor equipment, (c) evaluate pathology in primates that may result from repetitive, chronic plus-Gz exposure, (d) develop a methematical model that may predict pathophysiologic response to plus-Gz stress, (e) program and test an AF manikin for simulation of human response to environmental stress.

Using the USAFSAM centrifuge, an animal analog of man will be examined during and following repetitively imposed plus-Gz stress over periods as long as 6 months. The principal approach will be the investigation of pathology that may result in critical organ systems or the adaptation that may occur. Again using the human centrifuge as a test bed, items used to monitor physiological function will be evaluated for g sensitivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0016, A BASIS FOR EVOKED POTENTIAL ASSESSMENT OF CERTAIN VISUAL FUNCTIONS
D. Regan, Dalhousie University, *Halifax, Nova Scotia, Canada* B3H 4H7 (DF058330; AFOSR-80-0161)

AF function - evoked potential recording is a means of objectively assessing specific visual functions that are relevant to flying and to assessing work load as one element of a work load test battery. Deficiency - the evoked potential literature must be assessed critically before tests are finally designed, and a number of specific experiments must be carried out before fully satisfactory evoked potential tests can be defined. Objective - the research will provide a basis for the design of evoked potential tests of stereoscopic vision, simple visual acuity, pattern (form) vision, and eye-brain conduction speed. How research contributes - the proposed work effort will enhance the realization of a multi-channel work load test battery capability useful for aircrew systems design and operation.

Existing hard copy digitally derived imagery previously developed as a standard data base will be used to collect both interpreter performance and subjectively scaled quality estimates from trained tactical USAF photointerpreters. As the validity of this effort is dependent upon the use of a real-task scenario, the photointerpreters will be provided with the classified interpretation keys and corollary information typically used in their interpretation tasks. Data collection, therefore, will take place in a typical area used by the photointerpreters during their normal duty hours and with representative USAF equipment such as light table, zoom microscope, and tube magnifiers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, DETERMINATION, STATE ESTIMATION AND PARAMETER IDENTIFICATION
J.C. Wang, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2-83)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0002, OPERATION OF A TECHNOLOGY APPLICATIONS PROGRAM (TAP)
M. Hackbarth, University of Kentucky, College of Arts & Sciences, Dept. of Computer Science, *Limestone & Euclid, Lexington, Kentucky* 40506 (NASW 3367)

SUPPORTED BY U.S. National Aeronautics & Space Admin.

7.0003, DEVELOPMENT OF COMPUTER SOFTWARE TO ANALYZE ENTIRE LANDSAT SCENES AND TO SUMMARIZE CLASSIFICATION RESULTS OF VARIABLE SIZE POLYGONS
B. Turner, Pennsylvania State University, University Park Campus, School of Science, Dept. of Computer Science, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (NAS 5-26166)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0004, INTEGRATED CONTROLS CONCEPTS
R.E. Fennell, Clemson University, College of Sciences, Dept. of Mathematics, *Long Hall, Clemson, South Carolina* 29631 (NAG 1-81)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0005, A THEORETIC STUDY OF SPLINES UNDER TENSION

A.K. Cline, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Computer Science, *200 W. 21st St., Austin, Texas* 78712 (NAG 1-79)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0006, APPLYING RECURSIVE CUE/MODEL HIERARCHIES TO SCHEMATA-BASED COMPUTER VISION

W.S. Havens, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Computer Science, *500 Lincoln Dr., Madison, Wisconsin* 53706 (MCS80-04882)

A major problem in model-driven vision systems is the invocation of appropriate models to interpret a given image. Typically, data-driven methods are employed to generate low-level image cues to select likely models as hypotheses. It has been pointed out that this method is ineffective. Low-level cues are highly ambiguous matching to any inappropriate high-level models.

As a solution to this problem, we propose to integrate model-driven and data-driven recognition in schemata representations by employing a recursive hierarchy of cues and models. Schema models are invoked both by primitive cues computed directly from the image and by abstract cues created recursively as the result of recognition. The successful recognition of a schema instance at one level in the hierarchy yields a context-sensitive cue to invoke schema models at higher levels.

These methods will be applied to understanding hand-drawn sketch maps and to automatically classifying urban aerial photography. This second application should be of significant assistance to remote sensing research in the automatic prediction of urban pollution from sediment run-off.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, TRANSPORT PROPERTIES OF SILICA ON SILICON

J.B. Wagner, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (DA0F9167; DAAG29-78-G-0060)

To contribute to an understanding of the thermal oxidation of silicon by studying the current-voltage characteristics of SiO2 at elevated temperatures under conditions whereby the contacts to the SiO2 are tested for Ohmic behavior and the chemical potentials of silicon and oxygen are fixed. Relevance - the research has immediate relevance to ongoing research at ERADCOM and to other Army and DOD programs. It is especially relevant to the program involved with the study of pressure oxidation of silicon.

High temperature (550-950 degrees C) electrical transport measurement of silica thermally grown on silicon will be made in an oxygen environment. Differing sample configurations will be chosen in order to separate contact effects and to resolve contradicting data in the literature. A special test fixture will be designed to eliminate the possibility of doping the oxide with hydrogen or hydroxyl ions, and material will be chosen to eliminate aliovalent ion doping from the substrate. The results will be utilized to interpret the mechanism of oxidation kinetics of silica on silicon.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0002, COHERENT CONVERSION OF THE SUNLIGHT SPECTRUM

T.K. Gustafson, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NAG 3-88)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0003, THEORETICAL STUDY OF AURORAL ARC FORMATION

M.K. Hudson, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NAGW 75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0004, STUDY OF INTRINSIC AND EXTRINSIC PROPERTIES OF SEMICONDUCTORS BY RESONANT RAMAN AND BRILLOUIN SPECTROSCOPIES

P.Y. Yu, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (DMR79-19463)

Resonant light scattering spectroscopies (RLSS) such as Raman and Brillouin scattering will be applied to obtain information on the intrinsic and extrinsic properties of semiconductors. The interaction of electron-hole pairs (excitons) with the sample surface and defects in semiconductors will be studied. Excitons can be reflected and/or annihilated by the sample surface. Exactly how excitons behave near the surface is still an open question. In light scattering experiments it is the excitons which are scattered by phonons, thus the scattering efficiencies will be used as probes of the exciton behavior near the surface. Also the strong enhancement in the scattering efficiencies in RLSS will be used to study defects in semiconductors. This technique has many advantages over existing optical techniques for studying defects. For example, it can be more sensitive than infrared absorption and more selective than photoluminescence. This technique will be used to study defect systems in semiconductors which are important in applications such as solid-state electronic and electrooptical devices.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, SPACE PLASMA PHYSICS THEORY AND SIMULATION

C.F. Kennel, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (NAGW 78)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0006, THEORY OF COMBINED SYNCHROTRON, CERENKOV, AND TRANSITION RADIATION

W. Tsai, University of Miami, School of Arts & Sciences, Dept. of Physics, *Coral Gables, Florida* 33124 (PHY78-01305)

A program of research in theoretical physics will be initiated to improve our understanding of electromagnetic radiation processes. Even though synchrotron, Cerenkov, and transition radiations are well known and have been extensively studied in the past, the importance of their combined effects has not been recognized until recently by Tsai and his collaborators. The new features emerging from the interference among these radiation processes can be applied to the study of plasma physics, solid-state physics, astrophysics, as well as to the design of new high-energy counters. Theoretical effort is needed to provide guidance for the design of experiments to exploit these new efforts.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0007, MATERIAL PROPERTIES AND PHENOMENA AT VERY LOW TEMPERATURES

J.B. Ketterson, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics, *633 Clark St., Evanston, Illinois* 60201 (DMR78-11771)

This is a continuation of work sponsored under DMR-7621370. An experimental study will be made of the properties of helium-3 and nuclear ordering in solid helium-3. A nuclear cooling cryostat will be constructed and longitudinal and transverse sound characteristics will be studied in superfluid helium-3. The magnetic properties of solid helium-3 will be examined. Sound propagation studies of liquid crystals will be continued. Transition metals will be examined at ultra-low temperatures for the existence of superconductivity. This work is important for understanding quantum solids and fluids and the low-temperature behavior of metals and liquid crystals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, ELEMENTARY PARTICLE THEORY

R.J. Oakes, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics, *633 Clark St., Evanston, Illinois* 60201 (PHY78-11607 A01)

This work in theoretical physics concentrates on problems in the area of Elementary Particle Theory, including the phenomenology of high energy processes and unified guage theories of the weak, electromagnetic and strong interactions of quarks and leptons. The research will be carried out primarily at the Fermi National Accelerator Laboratory.

Work in progress on hadronic production of muon pairs, which has emphasized the degree to which this reaction can be used to test Quantum Chromodynamics, will be extended to include the production of a gluon jet of hadrons along with the muon pair. The production and detection of both neutral and charged Higgs bosons by various beams at the Fermilab Tovatron will be investigated. Further plans are to examine the production of very massive Higgs bosons via weak processes by proton-proton and electron-proton colliding beams.

More fundamental research will emphasize an investigation of unified guage theories of weak, electromagnetic and strong interactions which include possible horizontal and super-strong gauge interactions. A number of specific questions will be explored: the possible role of the exceptional Lie groups, generalized gauge hierarchies, dynamical symmetry breaking, CP nonconservation in the superstrong gauge sector and nonconservation of baryons and leptons. Throughout this investigation there will be a search for experimental consequences that are feasible to explore at present or planned facilities.

This work is a continuation of that currently supported under NSF grant PHY78-11607.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0009, DEFECT PROPERTIES OF SOLIDS

D. Lazarus, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics/Materials Research Laboratory, *207 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

Our research program is directed toward understanding the basic atomistic mechanisms responsible for mass flow (diffusion) in solids and effects of high pressure on defect and electronic properties of solids. Measurements of diffusion with radioactive tracers have disclosed anomalies in body-centered cubic transition metal systems. Measurements are also underway involving mass and charge transport in superionic solids as functions of both temperature and pressure. We are also studying the effects of high pressure on the electronic properties of micromagnetic and spin glass alloys and of amorphous metals ('metal glasses').

SUPPORTED BY U.S. Dept. of Energy

8.0010, SPECTROSCOPY OF THERMAL ENERGY TRANSPORT

W.E. Bron, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DA0G2312; DAAG29-80-C-0085)

To study the interaction of laser light with solids and phonon-based thermal energy transport. Relevance - the techniques and results are important to a number of technologies including thermal transport, the effect of laser light on solids, solar absorbers, heat conduction in microelectronics, and acoustic delay lines.

Direct observations are to be carried out on the frequency dependence and interaction strengths of anharmonic processes using vibronic side-band spectroscopy and coherent phonon generation through piezoelectric surface excitation with laser light. The investigation is to include resolution of the effects of competing interaction modes on measurements of phonon lifetimes, an account of crystal anisotropies and a determination of phonon lifetimes over phonon frequencies in the range from 1 to 10 THz.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0011, A STUDY OF DISCONTINUITIES AND RADIATION PROCESSES IN SOLAR TERRESTRIAL PLASMAS

K. Papadopoulas, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAGW 81)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0012, ACQUISITION OF RESEARCH EQUIPMENT FOR SPECTRUM ANALYZER

A.G. Zajonc, Amherst College, Graduate School, Dept. of Physics, *Box 65, Amherst, Massachusetts* 01002 (CDP79-26246)

The award provides funds for a spectrum analyzer needed to perform three independent experiments: 1) a study of the dynamics of smectic liquid crystalline thin films by Mark A. Peterson, 2) parity nonconservation in atomic physics by Arthur G. Zajonc, and 3) noise measurements on ferroelectrics in the vicinity of the ferroelectric phase transition by Robert H. Romer.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management, Div. of Budget & Program Analysis

8.0013, THEORETICAL PROGRAM IN PLASMA AND MAGNETO HYDRODYNAMICS PROCESSES RELEVANT TO THE SOLAR CORONA AND ITS ANALOGUES

R. Rosner, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NAGW 79)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0014, CRYSTAL GROWTH BY SKULL MELTING

A. Linz, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0E9123; DAAG29 76 C 0039)

To develop the skull growth of high purity yttrium vanadate crystals. Relevance - yttrium vanadate crystals are attractive as a laser host material for use in laser range-finders and target designators. This program will address the development of a growth technique for which crystals may be obtained free of inclusions, bubbles, and cleavage fractures due to poor diameter control.

A detailed electrical and thermal analysis of the skull system will be carried out to predict temperature profiles - electrical conductivity measurements will be obtained on the solid and liquid phases - and design of the skull growth process and

growth and characterization of high purity vanadate crystals will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0015, A SEARCH FOR NEUTRAL CURRENT INTERACTIONS IN ATOMIC HYDROGEN AND DEUTERIUM
W.L. Williams, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY79-25044)

This grant will provide continued support for an experimental program to measure the coupling constants of the parity nonconserving (PNC) neutral current interaction between the electron and nucleons in atomic hydrogen and deuterium. An atomic beams apparatus for determining the vector electron-axial vector nucleon coupling constants (C2p and C2n) is in operation. The transition is a configuration of helical fields; a PNC electron-proton interaction will result in interference terms in the transition rate dependent on the pitch sense of the region. In addition to precise measurements of C2p and C2n the program includes development of the transition region for measuring the axial vector electron-vector nucleon coupling constants (C1p and C1n). The construction of the beams apparatus for this experiment will take place in the second year. Also, development of an improved source of H(2S) and D(2S) atoms will be pursued in the first year for use with the existing as well as the new apparatus.

This is the first year of a two-year continuing grant, currently supported under NSF grant PHY77-25712A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0016, STUDY OF THE EFFECTS OF COSMIC DUST PARTICLE IMPACTS ON MASS SPECTROMETERS
C.L. Bailey, Concordia College at Moorehead, Undergraduate School, Dept. of Physics, *Moorhead, Minnesota* 56560 (NAS 5-26221)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0017, THEORETICAL STUDIES GROUP ON THE PHYSICS OF THE SOLAR ATMOSPHERE AND THE SOLAR WIND
L.A. Fisk, University System of New Hampshire, University of New Hamsphire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (NAGW 76)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

8.0018, THEORETICAL STUDIES OF ATOMIC COLLISIONS
V. Franco, City University of New York, Brooklyn College, School of Science, Dept. of Physics, *Bedford Ave. & Ave. H, Brooklyn, New York* 11210 (PHY80-08535)

Research in theoretical atomic collisions physics initiated under NSF grant PHY78-11611 will be continued. The topics of interest include both direct collisions and rearrangement collisions, with emphasis upon intermediate and high energy elastic scattering and excitation of neutral atoms and ions by charged particles, by ions, and by neutral atoms, ionizing-collisions, identical particle exchange collisions and charge transfer collisions. The calculations are of both theoretical and practical interest in atomic physics. They are also relevant to aspects of astrophysics and atmospheric physics, to dispersion of swift charged particle or neutral atom beams passing through neutral gases or hot plasma.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, THE FLOW OF PLASMA IN THE SOLAR TERRESTRIAL ENVIRONMENT
R.W. Schunk, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (NAGW 77)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0020, THE INFLUENCE OF AEROSOLS ON ELECTRIC PARAMETERS IN THE FREE ATMOSPHERE
D.J. Hofmann, University of Wyoming, School of Arts & Sciences, Dept. of Physics, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DA0F8900; DAAG29 77 G0046)

To assess the degree of influence that the natural aerosol in the stratosphere has on electrical parameters such as ion density and conductivity. Relevance - the work directly supports research programs at the Atmospheric Sciences Laboratory and the Ballistic Research Laboratories relating to atmospheric effects upon communications, the high energy laser and ballistic missile defense systems.

Construct a new and better instrument to reliably measure ion density from a balloon-borne platform to be launched from Laramie Station (41 degrees N). This new instrument, plus a dustsonde, will be used to make simultaneous balloon-borne soundings of small ion density and the aerosol concentration in the stratosphere. The corresponding structure and variation in the two profiles will be analyzed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0021, SWEPT EXCITED AMPLIFIERS/FLUCTUATIONS/CORRELATIONS IN COOPERATIVE PROCESS
R. Bonifacio, Istituto Nazionale de Ottica, *Largo Enrico Fermi 6, Florence, Italy* (DA0D9341; DAERO 77 G0054)

Conduct a theoretical investigation into the following four areas: A. Quantum theory of swept-excited amplifiers - superradiant pi pulses in an amplifier with linear losses (S.S.P.) have been described previously assuming that the decay time t1 of the atomic populations is very long with respect to the decay time t2 of the polarization. In a X-ray laser scheme recently proposed, however, this limit is no longer true. B. Coherent transient effects in a Josephson-junction - a fully quantum theory is necessary in order to describe quantum correlations and fluctuations in the radiation emitted by a Josephson-junction in a transient behavior. C. Quantum fluctuations and correlations in superfluorescence - numerical calculations are necessary in order to evaluate fluctuations in oscillatory superfluorescence. D. New approaches in laser theory - a new approach is to be studied which allows giving an explicit description of the photon statistics without any approximation on the laser intensity which can be arbitrarily large.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

8.0022, PERCOLATION AND CRITICAL BEHAVIOR IN MANY-BODY SYSTEMS
C. Domb, University of London, Kings College, Dept. of Physics, *Strand, London, England, United Kingdom* (DA0C9484; DAERO 77 G0007)

To undertake research on theoretical calculations of various critical phenomena in such areas as spontaneous polymerization, explosions, glasses, ceramics, and magnetic alloys. These calculations provide the bench marks for other theories as well as simulations to be measured against.

This work will combine the series expansions which have been developed for percolation processes with the Monte Carlo methods developed at AMMRC to obtain a better understanding of the nature of critical percolation. The critical behavior of dilute magnets and spin glasses will be investigated. Information of the shape and size of percolation clusters will be used to develop further the droplet model of nucleation, and to investigate the nature of metastable states. Enumerative techniques used for series expansions will be applied to polymer chains in solution

and spin glasses to explore their configurational behavior and phase transitions, and the nature of the glassy state.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, X-RAY ASTRONOMY INSTRUMENTATION STUDIES
Unknown, University of Alabama in Huntsville, Graduate School, Dept. of Astronomy, *Huntsville, Alabama* 35807 (NAS 8-33977)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0002, SPECTROSCOPIC OBSERVATIONS OF COMETS
S. Larson, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAG 5-86)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0003, COLLOQUIUM AND BOOK ON COMETS
L.L. Wilkening, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NASW 3413)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0004, CONTROLLED AND NATURALLY OCCURRING WAVE PARTICLE INTERACTION (INVESTIGATION ON DYNAMICS EXPLORER PHASE III)
R.A. Helliwell, Stanford University, School of Humanities & Sciences, Dept. of Astronomy, *Stanford, California* 94305 (NAS 5-25688)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0005, DEFINITION STUDY FOR AN ADVANCED COSMIC RAY EXPERIMENT UTILIZING THE LONG DURATION EXPOSURE FACILITY (LDEF)
P.B. Price, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAS 1-16268)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

10.0006, THEORETICAL STUDIES OF EXTRAGALACTIC GRAINS
M. Jura, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (NAGW 80)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0007, THE RELATIONS BETWEEN OPTICAL AND X-RAY EMISSION FROM QUASARS AND BL LAGERTAE OBJECTS
J.S. Miller, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy, *Santa Cruz, California* 95060 (NAG 8-352)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0008, GIANT X-RAY RING OF CYGRUES WITH EINSTEIN OBSERVATORY X-RAY SUPERBUBBLES AND LOW TEMPERATURE X-RAYS (ABBREV)
W.C. Cash, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 8-353)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0009, INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) STUDIES OF COOL STARS
J.L. Linsky, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-82)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0010, OBSERVATIONAL INVESTIGATIONS OF FACTORS CONTROLLING THE EVOLUTION OF GALAXIES
J.S. Gallagher, University of Illinois, Urbana Champaign Campus, School of Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST79-09977)

Among the major problems in galactic structure and evolution is the understanding of the content of neutral hydrogen, stellar populations, abundances, and global structure characteristics of various types of galaxies. In this project, these characteristics will be studied in two subclasses of galaxies, the hydrogen-rich SO and related galaxies, and a group of galaxies with anomalous stellar populations. The hydrogen-rich SO galaxies have as much gas as normal spirals, yet show no spiral structure. This project will study what, if any, interaction exists between the gas and the stellar population of these galaxies. The anomalous stellar population galaxies may have had either a burst of star formation or an abnormal distribution of stellar masses. This research should provide data that will distinguish between these two possibilities. In addition, some data on the build-up of heavy elements in galaxies will be obtained. This work will utilize observations made at the National Radio Astronomy Observatory in Greenbank, West Virginia, The Cerro Tololo Interamerican Observatory in Chile, the Kitt Peak National Observatory in Arizona, and the Prairie Observatory of the University of Illinois.

This is a continuation of work being done under AST-7718270.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0011, STUDY THE DYNAMICS OF OLD SUPERNOVA REMNANTS BY COMPARISON OF MULTIWAVELENGTH DATA
J.R. Dickel, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (NAG 5-84)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0012, RESEARCH OF MASS LOSS FROM SELECTED SUPERGIANT STARS
S.A. Lamb, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (NAG 5-85)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0013, FOLLOW-UP STUDY OF CG284-1 REGION - TIMING STUDIES OF X-RAY SOURCES POSSIBLY LINKED TO X-RAY SOURCES

R.C. Lamb, Iowa State University of Science & Technology, College of Humanities & Sciences, Dept. of Physics, *Beardshear Hall, Ames, Iowa* 50010 (NAG 8-360)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0014, STUDIES OF CRAB NEBULA-LIKE SUPERNOVA REMNANTS

A.S. Wilson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NAG 8-349)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0015, RADIO OBSERVATIONS OF PULSARS

J.H. Taylor, University of Massachusetts, Amherst Campus, School of Arts & Sciences, Dept. of Astronomy, *Amherst, Massachusetts* 01002 (AST79-19239)

This research will be directed towards two broad goals: continued improvements in our understanding of pulsars and their place in the scheme of steliar and galactic evolution; and continued exploitation of the one known pulsar in a binary pulsar as a testing ground for gravitation theory. Observations of the binary pulsar have shown that the system is losing energy at a rate within 30 percent of that expected on the basis of gravitational radiations within the theory of general relativity. The present work will be aimed at obtaining further information on the statistical properties of pulsars.

The observations will be continued over the period of this grant, and new apparatus will be constructed which will improve the accuracy of pulsar timing measurements by a factor of two. In particular, measurements of the binary pulsar will continue in an effort to test certain aspects of the theory of general relativity.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0016, COMPACT V-V GROUPS OF GALAXIES

N.A. Bahcall, Princeton University, School of Natural Sciences, Dept. of Astrophysical Sciences, *Box 430, Princeton, New Jersey* 08540 (NAG 8-363)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0017, THEORETICAL & LABORATORY PLANETARY PHYSICS

R.E. Danielson, Princeton University, School of Natural Sciences, Dept. of Astrophysical Sciences, *Box 430, Princeton, New Jersey* 08540 (NSG 7053)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0018, A STUDY OF THE PERFORMANCE OF STRESSED PHOTOCONDUCTOR DETECTORS FOR FAR INFRARED ASTRONOMY

M. Harwit, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Astronomy, *Ithaca, New York* 14850 (NCA 2-175002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0019, THE GALACTIC SUPERNOVA REMNANT S147

A.E. Glassgold, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (NAG 8-358)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0020, INTERACTING CLOSE BINARY SYSTEMS

G.E. McCluskey, Lehigh University, School of Arts & Sciences, Dept. of Astronomy, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (NAG 8-355)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0021, ABUNDANCE EFFECTS ON MASS LOSS IN SELECTED STARS

S.B. Parsons, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NAG 5-80)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0022, HIGH ENERGY ASTRONOMICAL OBSERVATORY-B GUEST INVESTIGATION SEARCH FOR X-RAYS ASSOCIATED WITH THE VARIABLE FAR-INFRARED SOURCES IN NGC 6334

J.C. Wheeler, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NAG 8-350)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0023, COORDINATED HIGH ENERGY ASTRONOMICAL OBSERVATORY-2 OBSERVATIONS OF LOW-FREQUENCY VARIABLE RADIO SOURCES

S.L. O'Dell, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Physics, *Blacksburg, Virginia* 24061 (NAG 8-348)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0024, CLUSTER HUBBLE-CONSTANT STUDY

P.E. Boynton, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (NAG 8-364)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0025, X-RAY IMAGES OF SPIRAL-RICH CLUSTERS OF GALAXIES

W.T. Sullivan, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (NAG 8-359)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0026, X-RAY STUDY OF FOUR BLUE GALACTIC EMISSION LINE OBJECTS

P. Szkody, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (NAG 8-361)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

GENERAL

11.0001, FLIGHT MANAGEMENT SYSTEMS
L. Stark, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering & Computer Sciences, *Berkeley, California* 94720 (NCC 2-86)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

VOLUME 19 NUMBER 1/JANUARY 8, 1981

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

No abstracts in this category.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N81-10001 Engineering Sciences Data Unit, London (England).
DRAG INCREMENT DUE TO REAR FUSELAGE UPSWEEP
1980 10 p
(ESDU-80006; ISBN-0-85679-290-X) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161

Drag increment due to rear fuselage upsweep is predicted. The results may be applied to the calculation of cruise drag. The research is relevant to military and civil transport aircraft subcritical Mach numbers. ESDU (GRA)

N81-10002 Pennsylvania State Univ., University Park.
AN ANALYSIS OF THE TURBULENT BUOYANT JET Ph.D. Thesis
Clifford Bruce Baker 1980 200 p
Avail: Univ. Microfilms Order No. 8024425

The problem of developing a theoretical model for an asymmetric turbulent buoyant jet is addressed. The governing equations for an axisymmetric turbulent buoyant vertical jet are transformed using jet similarity variables. In this transformation, a length scale is introduced which controls the buoyancy term in the jet equations. In the limit as this length scale approaches zero, the buoyancy effects vanish and the jet equations are recovered. As this length scale approaches infinity, the plume equations are obtained. A perturbation expansion is developed for the near jet yielding a system of ordinary differential equations. Asymptotic equations are developed from which the plume solution is recovered. Analytical and numerical solutions are carried out using several eddy viscosity models. The solutions compare favorably with available experimental data on the buoyant jet centerline. The off axis jet data appear to be in error because the mean velocity data fail to satisfy the momentum integral constraint. Dissert. Abstr.

N81-10003 Kansas State Univ., Manhattan.
SIMULATION OF EFFECT OF WIND BARRIERS ON AIRFLOW Ph.D. Thesis
Lawrence Jacob Hagen 1980 121 p
Avail: Univ. Microfilms Order No. 8024249

A quantitative, theoretical simulation of airflow normal to narrow wind barriers of various porosities is presented. Five linked partial differential equations were used to simulate the air flow near wind barriers. The differential equations described the conservation of horizontal momentum, vertical momentum, mass, turbulence energy, and dissipation rate of turbulence energy. In addition, an algebraic turbulence model was used to relate the turbulent viscosity to the turbulent energy and turbulent energy dissipation rate. Finite difference methods which used a combination of upwind and central difference schemes were used to solve the equations. Upwind, downwind, and tip boundaries of the solution domain were selected so they would not be influenced by the barrier. At those locations, boundary conditions were based on the well known logarithmic windspeed profile and neutral atmospheric stability. As a barrier boundary condition, the porous wind barriers were treated as sources of horizontal velocity. The source strength for 20, 40, and 60 percent porous slat fence barriers was determined by measuring the leeward windspeed profiles at 0.5 to 1.0 H. Dissert. Abstr.

N81-10004*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ESTIMATION OF WING NONLINEAR AERODYNAMIC CHARACTERISTICS AT SUPERSONIC SPEEDS
Harry W. Carlson and Robert J. Mack Nov. 1980 84 p refs
(NASA-TP-1718; L-13589) Avail: NTIS HC A05/MF A01 CSCL 01A

A computational system for estimation of nonlinear aerodynamic characteristics of wings at supersonic speeds was developed and was incorporated in a computer program. This corrected linearized theory method accounts for nonlinearities in the variation of basic pressure loadings with local surface slopes, predicts the degree of attainment of theoretical leading edge thrust, and provides an estimate of detached leading edge vortex loadings that result when the theoretical thrust forces are not fully realized. T.M.

N81-10005*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A FAN PRESSURE RATIO CORRELATION IN TERMS OF MACH NUMBER AND REYNOLDS NUMBER FOR THE LANGLEY 0.3 METER TRANSONIC CRYOGENIC TUNNEL
Pierce L. Lawing and Charles L. Ladson Nov. 1980 21 p refs
(NASA-TP-1752; L-13713) Avail: NTIS HC A02/MF A01 CSCL 01A

Calibration data for the two dimensional test section of the Langley 0.3 Meter Transonic Cryogenic Tunnel were used to develop a Mach number-Reynolds number correlation for the fan pressure ratio in terms of test section conditions. Well established engineering relationships combined to form an equation which is functionally analogous to the correlation. A geometric loss coefficient which is independent of Reynolds number or Mach number was determined. Present and anticipated uses of this concept include improvement of tunnel control schemes, comparison of efficiencies for operationally similar wind tunnels, prediction of tunnel test conditions and associated energy

usage, and determination of Reynolds number scaling laws for similar fluid flow systems. T.M.

N81-10006*# Pennsylvania State Univ., University Park.
ANALYTICAL AND EXPERIMENTAL STUDY OF MEAN FLOW AND TURBULENCE CHARACTERISTICS INSIDE THE PASSAGES OF AN AXIAL FLOW INDUCER Final Report
C. A. Gorton and B. Lakshminarayana Washington NASA Nov. 1980 179 p refs
(Grant NGL-39-009-007)
(NASA-CR-3333; PSU-Aersp-74-2) Avail: NTIS HC A09/MF A01 CSCL 01A

The inviscid and viscid effects existing within the passages of a three bladed axial flow inducer operating at a flow coefficient of 0.065 are investigated. The blade static pressure and blade limiting streamline angle distributions were determined and the three components of mean velocity, turbulence intensities, and turbulence stresses were measured at locations inside the inducer blade passage utilizing a rotating three sensor hotwire probe. Applicable equations were derived for the hotwire data reduction analysis and solved numerically to obtain the appropriate flow parameters. The three dimensional inviscid flow in the inducer was predicted by numerically solving the exact equations of motion, and the three dimensional viscid flow was predicted by incorporating the dominant viscous terms into the exact equations. The analytical results are compared with the experimental measurements and design values where appropriate. Radial velocities are found to be of the same order as axial velocities within the inducer passage, confirming the highly three dimensional characteristic of inducer flow. Total relative velocity distribution indicate a substantial velocity deficiency near the tip at mid-passage which expands significantly as the flow proceeds toward the inducer trailing edge. High turbulence intensities and turbulence stresses are concentrated within this core region. Considerable wake diffusion occurs immediately downstream of the inducer trailing edge to decay this loss core. Evidence of boundary layer interactions, blade blockage effects, radially inward flows, annulus wall effects, and backflows are all found to exist within the long, narrow passages of the inducer. M.G.

N81-10007# *Aeronautical Research Labs., Melbourne (Australia).*
AN INTRODUCTION TO DYNAMIC DERIVATIVES (3) METHODS OF OSCILLATING MODELS IN PITCH AND YAW *IN A 530 BY 810 MILLIMETRE TRANSONIC WIND* TUNNEL
G. F. Forsyth Apr. 1979 45 p refs
(ARL/Aero-Note-390; AR-001-724) *Avail: NTIS* HC A03/MF A01

Mechanisms are considered which allow models to be oscillated in pitch and yaw during wind tunnel tests to measure dynamic derivatives. Types of pivots, motion producing linkages and connecting linkages are described as applicable in a 530 by 810 millimeter transonic tunnel. Author

N81-10008# *TRW Systems and Energy, Redondo Beach, Calif.* Engineering Sciences Lab.
HOLOGRAPHIC INVESTIGATION OF SLENDER BODY *VORTEX WAKES Final Report, 28 Jul. 1978 - 28 Mar.* 1980
F. D. Deffenbaugh and J. L. Jacoby Jul. 1980 79 p refs
(Contract F33615-78-C-3028; AF Proj. 2307)
(AD-A089496; TRW-32399-6002-UT-00; AFWAL-TR-80-3061) Avail: NTIS HC A05/MF A01 CSCL *20/4*

The three dimensional vortex flow field behind slender missile configurations at high angle of attack was investigated using laser holography. Holographic interferograms of the flow about two ogive cylinder models were recorded for low speed flows, M less than .1, at angles of attack from 20 to 50 degrees. Helium injected into the flow above the model was entrained into the entire vortex structure, and the three dimensional position of the core could not be determined from the interferograms. Dual exposure holograms of the flow field seeded with 40-100 micron glass microballoons were recorded using a pulsed ruby laser. Pairs of particles could not be easily identified in the reconstructed image and the three dimensional velocity field could not be measured. Surface pressures were measured and integrated to provide load distributions, normal and side force coefficients. Roll angle was varied with angle of attack and tunnel conditions constant. Conditions of maximum vortex asymmetry were determined from the measured pressure distributions. GRA

N81-10009# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
MARITIME PATROL AIRSHIP STUDY (MPAS) Final Report
David B. Bailey and Harold K. Rappoport (Summit Research Corp., Gaithersburg, Md.) 19 Mar. 1980 331 p refs
(Contract MIPR-Z-70099-8-85; WF414110)
(AD-A089483; NADC-80149-60) Avail: NTIS HC A15/MF A01 CSCL 01/2

The Maritime Patrol Airship Study is an airship system applications study sponsored by the U.S. Navy and U.S. Coast Guard. Eight Major Cost Guard programs are analyzed for cost effective benefits of modern Lighter-Than-Air (LTA) vehicles. Representative script scenarios are developed for the eight programs based on actual Coast Guard mission experience. The scenarios are then used to size conceptual vehicles. In addition to in-house vehicle analysis, two independent efforts for comparative purposes based on the same scenarios were performed by contractor support. GRA

N81-10010# *Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.*
AN INVESTIGATION OF SCALE EFFECTS ON *THE TRANSONIC FLOW OVER SWEPT WINGS. PART 2: MEASUREMENTS ON A MODEL OF A VARIABLE-SWEEP STRIKE-FIGHTER CONFIGURATION*
D. J. Weeks and J. Hodges London Dec. 1977 127 p refs Supersedes RAE-TR-77184; ARC-37815
(ARC-R/M-3842-Pt-2; BR73152; RAE-TR-77184; ARC-37815)
Avail: NTIS HC A07/MF A01; HMSO £14 PHI

Measurements of forces and wing pressures were made on a wing plus body half-model of a variable sweep strike fighter configuration at Mach numbers between 0.6 to 0.825 and at Reynolds numbers in the range 2.3 X 10 to the 6th power to 19 X 10 to the 6th power. Results were obtained with the wings swept at both 25 deg and 40 deg. The data were analyzed to show the effects of changes in Reynolds number, and in the location of transition, on the transonic flows over the upper surface of the wing at high incidence. For the 25 deg sweep configuration results are described which are consistent with those observed on the transport aircraft wing. The 40 deg sweep configuration gave examples of scale effect which were essentially three dimensional in nature and which persisted up to full scale Reynolds numbers. Author (ESA)

N81-10011# *Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).*
ANALYTICAL CHARACTERISTICS METHODS: APPLICATIONS
R. Stuff (DFVLR, Goettingen, West Germany) 1980 57 p refs
Presented at Von Karman Inst. Lecture Ser. on Mathematical Methods in Fluid Mech., Rhode Saint Genese, Belgium, 25-29 Feb. 1980 Submitted for publication
(VKI-Preprint-1980-10) Avail: NTIS HC A04/MF A01

The prerequisites for application of the analytical characteristics method include analytical descriptions of the geometry of wave fronts and rays, and analytical solutions of the wave equation of the potential equation for supersonic flow. The latter are applied as initial solutions to the analytical characteristics method. Examples of application range from unsteady subsonic to steady supersonic flow, from theoretical predictions to the evaluation of the flow field from near field wind tunnel test data. Author (ESA)

N81-10012# *National Aerospace Lab., Amsterdam (Netherlands).* Flight Div.
IN-FLIGHT MEASUREMENT OF AERODYNAMIC LOADS ON *CAPTIVE STORES. EQUIPMENT AND RESULTS*
G. J. Alders 17 Apr. 1979 12 p refs Presented at AGARD Flight Mech. Panel Symp. on Missile System Flight Dyn., London, *21-24 May 1979*
(NLR-MP-79013-U) Avail: NTIS HC A02/MF A01

A force balance store was developed, consisting of a support structure to be mounted on a 14 in. bomb rack, a load

measuring balance and a shape representing the store to be analyzed. The shape is replaceable. A series of flight tests with two different force balance store shapes was carried out with an NF-5 aircraft. The store was mounted in the normal captive position as well as 0.15 m below. The results of the measurements are compared with data from other sources, such as wind tunnel results. Predictions, made with the computer model and using the aerodynamic data obtained with the force balance store are compared with actual drop test results. The excellent agreement indicates that in flight measurement of airloads on captive stores is a valuable tool for a better determination of the safe release envelope of external stores. Author (ESA)

N81-10013# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

A COMPREHENSIVE EVALUATION AND ANALYSIS OF TRANSONIC FLOW CALCULATIONS ON THREE RELATED WING-BODY CONFIGURATIONS

Georg Drougge, N. Agrell, and S. Hedman 1979 40 p refs (Contract FMV-F-K-82223-76-001-21-001)
(FFA-TN-AU-1418-PT-1) Avail: NTIS HC A03/MF A01

The design of a wing-body combination where an inverse procedure analysis based on the transonic small disturbance theory was studied. Features of aerodynamic interest were found. This led to modifications in the use of the numerical method in the wing-body design. The modified wing-body combination was again tested and the results analyzed further. It was concluded that the inverse method can be a powerful design tool and that in any case for moderate aspect ratios the concept of a wing as formed from two dimensional profiles can be replaced by the concept of a wing formed from two surfaces. Author (ESA)

N81-10014# National Aerospace Lab., Amsterdam (Netherlands). Incompressible Aerodynamics Div.

BOUNDARY LAYER MEASUREMENTS ON A TWO-DIMENSIONAL WING WITH FLAP

B. vandenBerg Jan. 1979 110 p refs
(Contract NIVR-1812)
(NLR-TR-79009-U) Avail: NTIS HC A06/MF A01

A wind tunnel experiment was performed on a wing flap configuration designed to prevent flow separations. The measurements comprised surface pressure measurements, boundary layer and wake traverses, and surface flow visualizations. Three angles of attack were applied and two widths of the gap between wing and flap, with mixing of wing wake and flap boundary layer occurring with the smaller gap. The flow phenomena were sufficiently well described by these measurements to make detail comparisons possible with calculation methods for the viscous flow around multielement airfoils. Author (ESA)

N81-10015# *Royal Aircraft Establishment, Farnborough (England).*

FLOW MEASUREMENTS IN THE WAKE OF A WING FITTED WITH A LEADING-EDGE ROOT EXTENSION (STRAKE)

P. J. Butterworth London HMSO Sep. 1979 40 p refs
(RAE-TR-79120; RAE-Aero-3464; BR72779) Avail: NTIS HC A03/MF A01

In a low-speed wind tunnel, measurements were taken of the velocity vector in the flow field behind the wing of a combat aircraft model. The wing was fitted with a leading-edge root extension (strake) and could have either a plain leading edge or a deployed slat outboard. Four flow investigations were made; at three angles of incidence with the plain leading edge and at one angle of incidence with the slat deployed. The distribution of the total head deficit, the streamwise component of vorticity, and a measure of the circulation distribution in the wake of the wing were computed. Author (ESA)

N81-10016# Royal Aircraft Establishment, Farnborough (England).

THEORETICAL DETERMINATION OF SUBSONIC OSCILLATORY AIRFORCE COEFFICIENTS FOR F.4-TAILPLANE CONFIGURATIONS

D. E. Davies London HMSO Sep. 1979 237 p refs
(RAE-TR-79125; RAE-Struct-BF/B/0794; BR79125) Avail: NTIS HC A11/MF A01

Linearized equations of potential flow are solved numerically for the loadings for oscillation at general frequency in any antisymmetric modes, and the generalized aerodynamic coefficients obtained. Approximation to the loadings are taken as linear combinations of basis functions. The condition satisfied by the loadings at the junction of the fin and half tailplanes is imposed on the approximations and the variational principle of Flax is applied to get the coefficients in the said linear combinations. The procedure is programmed in ICL 1900 FORTRAN. Results obtained using the program on a number of examples are given. Author (ESA)

N81-10017# European Space Agency, Paris (France).

ANALYSIS OF CALCULATED THREE-DIMENSIONAL INVISCID FLOW FIELDS WITH EMBEDDED SHOCK WAVES (PRESENTATION OF A FIELD SOLUTION), PART 1

Claus Weiland and Hans-Juergen Thies Jul. 1979 52 p refs Transl. into ENGLISH of "Anal. Berechneter Dreidimensionaler Reibungsfreier Stroemungsfelder mit Eingebetteten Verichtungsstoessen (Darstellung einer Feldoesung) Teil 1", Rept. DFVLR-FB-78-09 DFVLR, Cologne, Apr. 1978 Original report in GERMAN previously announced as N79-30155
(ESA-TT-558; DFVLR-FB-78-09) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 27,90

Flow fields around a number of different body contours, and calculated by means of a finite difference procedure are analyzed. The investigated fields are three dimensional in general. The analysis is carried out with the air of characteristics, streamlines, lines of constant static pressure and static density, and with the velocity vectors at the gridpoints in planes phi = const. Planes z = const lines of constant cross flow Mach number and the velocity vectors of the crossflow at the gridpoints are presented. The interval of freestream Mach number considered is 1.4 M sub infinity < or = M < or = 3, and the range of angle of attack alpha is up to 20 deg. The quality of the finite difference solution used is demonstrated by comparison with experimental data. The accuracy attained especially for the detection of the position and the contour of embedded shocks is very good. Author (ESA)

N81-10018# *European Space Agency, Paris (France).*

ANALYTICAL ESTIMATION ON NONLINEAR LONGITUDINAL CHARACTERISTICS OF WINGS WITH SMALL AND *MODERATE ASPECT RATIO BY THE VORTEX LATTICE* METHOD IN INCOMPRESSIBLE FLOW

Wolfgang Schroeder Jan. 1980 80 p refs Transl. into ENGLISH of 'Berechnung der nichtlinearen Beiwerte von Fluegeln mit kleinem u. mittlerem Seitenverhaeltnis dem Wirdbelleiterverfahren in inkompressibler Stroemung', DFVLR, Brunswick Report DFVLR-FB-78-26, Sept. 1978 Original report in GERMAN previously announced as N79-30161 Original German report available from DFVLR, Cologne DM 31,80
(ESA-TT-585; DFVLR-FB-78-26) Avail: NTIS HC A05/MF A01

A nonlinear vortex-lattice method is described applying a force-free condition to the vortex sheet given the trailing-, side- and leading edges, respectively. In extensive test runs various influences on the numerical stability of the iterative rolling up process were studied such as the force free condition of the wake, the number of horseshoe vortices, the panel distribution along span and chord, the representation of the wakes by chains of straight vortex elements of different length and number, and the introduction of an artificial friction parameters. Because of numerical difficulties the slender delta wing itself could not be treated completely. These numerical difficulties resulting from the singular behavior of line vortices are described and ways of overcoming them are suggested. Author (ESA)

N81-10948# Centre National de la Recherche Scientifique, Toulouse (France).

TRANSMEDITERRANEAN FLIGHTS

A. Soubrier, M. Malavasi (CNR), and J. Pueyo (Comision Nacl. de Invest. del Espacio) *In ESA European Rocket and Balloon* Programs and Related Res. Jun. 1980 p 219-221 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N81-10019*# Human Resources Research Organization, Alexandria, Va.
CIVIL HELICOPTER WIRE STRIKE ASSESSMENT STUDY. VOLUME 2: ACCIDENT ANALYSIS BRIEFS Final Report
Clyde H. Tuomela and Mark F. Brennan Oct. 1980 221 p
(Contract NAS2-10505)
(NASA-CR-152390; FR-MTRD(CA)-80-13-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 01C

A description and analysis of each of the 208 civil helicopter wire strike accidents reported to the National Transportation Safety Board (NTSB) for the ten year period 1970-1979 is given. The accident analysis briefs were based on pilot reports, FAA investigation reports, and such accident photographs as were made available. Briefs were grouped by year and, within year, by NTSB accident report number. T.M.

N81-10020*# Crash Research Inst., Tempe, Ariz.
SYSTEMS ANALYSIS OF THE INSTALLATION, MOUNTING, AND ACTIVATION OF EMERGENCY LOCATOR TRANSMITTERS IN GENERAL AVIATION AIRCRAFT Final Report
David S. Hall 10 Jan. 1980 218 p
(Contract NAS5-25444)
(NASA-CR-160036; CRI-7846-14) Avail: NTIS HC A10/MF A01 CSCL 01C

A development program was developed to design and improve the Emergency Locator Transmitter (ELT) transmitter and to improve the installation in the aircraft and its activation subsystem. There were 1135 general aviation fixed wing aircraft accident files reviewed. A detailed description of the damage to the aircraft was produced. The search aspects of these accidents were studied. As much information as possible about the ELT units in these cases was collected. The data should assist in establishing installation and mounting criteria, better design standards for activation subsystems, and requirements for the new ELT system design in the area of crashworthiness. T.M.

N81-10021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Jan. - 31 Mar. 1979
Apr. 1980 34 p refs Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.
(NASA-TM-81225; A-8311; QR-11) Avail: NTIS HC A03/MF A01 CSCL 01C

A comprehensive study of near midair collisions in terminal airspace, derived from the ASRS database is presented. A selection of controller and pilot reports on airport perimeter security, unauthorized takeoffs and landings, and on winter operations is presented. A sampling of typical Alert Bulletins and their responses is presented. T.M.

N81-10022# Federal Aviation Administration, Atlantic City, N.J. Technical Center.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN AIRCRAFT CRASHWORTHINESS
C. A. Caiafa and Lawrence M. Neri Jun. 1980 55 p refs
(AD-A089431; FAA-CT-80-166; FAA-ED-18-6) Avail: NTIS HC A04/MF A01 CSCL 01/2

The Aircraft Crashworthiness Program Plan is designed to reduce or prevent aircraft occupants from incurring serious or fatal injuries in a survivable crash impact accident by incorporating crashworthy design features into the initial stages of fixed-wing and rotary-wing aircraft development. It describes a 5 year development program for both airplanes and rotorcraft. It identifies five major subprogram areas for study and analysis to accomplish the programs goals: (1) Airframes; (2) Cabin safety; (3) Fuel system protection; (4) Emergency evacuation system; and (5) Standards, criteria, and procedures. The plan emphasizes use of available background data, development of analytical techniques, validation of analytical techniques, validation of data to determine feasibility/acceptability and transmittal of appropriate data for consideration as the basis for regulation, standards, etc. The federal aviation administration groups, other government agencies/departments and industry organizations participating in this effort are identified. Program schedule with milestones is presented. Program management and funding requirements are also identified. GRA

N81-10023# Battelle Columbus Labs., Ohio.
EVALUATION OF SAFETY PROGRAMS WITH RESPECT TO THE CAUSES OF GENERAL AVIATION ACCIDENTS. VOLUME 2: APPENDICES
T. M. Connor and C. W. Hamilton May 1980 266 p
(Contract DOT-FA78WA-4159)
(AD-A089181; FAA-ASP-80-2A) Avail: NTIS HC A12/MF A01 CSCL 01/2

The extent to which the Federal Aviation Administration (FAA) safety programs wwere aligned with the causes of general aviation accidents was determined. The data base used consisted of a total of 30,592 general aviation accident records compiled by the National Transportation Safety Board (NTSB) from 1971 through 1977. Analysis of these records was made with respect to NTSB-cited cause/factors. The FAA programs implemented during the study time period and pertaining to safety were also included in this study. R.C.T.

N81-10024# Terrestrial Environmental Specialist, Inc., Phoenix, N.Y.
HANDBOOK ON BIRD MANAGEMENT AND CONTROL Final Report, Aug. 1977 - Feb. 1979
Vincent J. Lucid and Roy S. Slack Mar. 1980 188 p refs
(Contract F08635-77-C-0377)
(AD-A089009; AFESC/ESL-TR-80-1) Avail: NTIS HC A09/MF A01 CSCL 06/6

This handbook was prepared to provide information to Air Force pest managers on hazardous and pest bird control. It discusses bird control in hangars, on airfields, and at other base locations. A systematic approach for surveying and determining control methods for bird problems is provided and legal aspects of bird control are discussed. Chapters two through eight have review questions to help the pest manager evaluate his proficiency in each subject area. A slide/tape presentation was prepared corresponding with information in this handbook. Copies are available for loan from Major Command Entomologists and the Air Force Engineering and Services Center. GRA

N81-10025# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
APPLICATIONS OF PYROTECHNIQUES IN AVIATION [DES APPLICATIONS DE LA PYROTECHNIE DANS LE DOMAINE AERONAUTIQUE]
S. Morlan Paris 1979 6 p In FRENCH Presented at Congr. on Explosifs et Pyrotech.: Appl. Spatiales, Toulouse, 22-25 Oct. 1979
(SNIAS-792-422-103) Avail: NTIS HC A02/MF A01

The cutting of canopies and windows in aircraft to permit abandonment in emergencies is discussed. The advantages of pyrotechnic logic circuits are presented. The use of pyrotechnics for opening cabin windows in a prototype Corvette aircraft is illustrated. Possible applications for assisting in ground evacuations in civilian transport aircraft are mentioned. Author (ESA)

N81-10026# National Technical Information Service, Springfield, Va.
SEARCH AND RESCUE METHODS AND EQUIPMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jun. 1980
Edith Kenton Jul. 1980 269 p Supersedes NTIS/PS-79/0649; NTIS/PS-78/0539
(PB80-812837; NTIS/PS-79/0649; NTIS/PS-78/0539) Avail: NTIS HC$30.00/MF$30.00 CSCL 06G

Maritime and aviation search and rescue are evaluated in approximately 262 abstracts. Search and rescue planning, locating equipment, rescue beacons, communication devices, specialized aircraft and their components, and searching strategies are discussed. GRA

N81-10027# National Technical Information Service, Springfield, Va.
BIRD STRIKES AND AVIATION SAFETY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
Guy E. Habercom, Jr. Jul. 1980 117 p Supersedes NTIS/PS-79/0753; NTIS/PS-78/0694
(PB80-812944; NTIS/PS-79/0753; NTIS/PS-78/0694) Avail: NTIS HC $30.00/MF $30.00 CSCL 01B

Hazards to aircraft created by engine ingestion or airplane interception of birds are investigated in these Government sponsored research reports. Bird damage assessment, structural strengthening, windshield design, and bird tracking and dispersal methods are studied. This updated bibliography contains 107 citations, 17 of which are new entries to the previous edition. GRA

N81-10028# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, U.S. GENERAL AVIATION CALENDAR YEAR 1978 Summary Report
20 May 1980 209 p
(PB80-201916; NTSB-ARG-80-1) Avail: NTIS HC A10/MF A01 CSCL 01B

A summary of aircraft accidents which occurred in U.S. general aviation operations during the calendar year 1978 is given. It includes an analysis of accident data providing an overview, types of accidents, accident causal factors, kind of flying, and conclusions; a statistical compilation of accident information presented in the form of accident and rate tables, analytic tables, injury tables and cause/factor tables. In 1978, there were 4,494 total general aviation accidents, 793 of which were fatal. Included in the total number of accidents are 63 collisions between aircraft. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N81-10029# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
RECOMMENDED SHORT-TERM ATC IMPROVEMENTS FOR HELICOPTERS. VOLUME 2: RECOMMENDED HELICOPTER ATC TRAINING MATERIAL Final Report, Aug. 1979 - Apr. 1980
Tirey K. Vickers and D. J. Freund Nov. 1980 82 p
(Contract DOT-FA79WA-4279)
(AD-A089441; FAA-RD-80-88-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 17/7

The recommended Short Term ATC Improvements for Helicopters are documented in three volumes. This volume provides complete training material for helicopter ATC. It contains major sections on Helicopter Capabilities and Limitations, on Helicopter Navigation and on Helicopter Control Procedures. GRA

N81-10030# Automation Industries, Inc., Silver Spring, Md.
RECOMMENDED SHORT-TERM ATC IMPROVEMENTS FOR HELICOPTERS. VOLUME 3: OPERATIONAL DESCRIPTION OF EXPERIMENTAL LORAN-C FLIGHT FOLLOWING (LOFF) IN THE HOUSTON AREA Final Report
Tirey K. Vickers and D. J. Freund Apr. 1980 32 p
(Contract DOT-FA79WA-4279)
(AD-A089385; FAA-RD-80-88-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 17/7

The recommended Short Term ATC Improvements for Helicopters are documented in three volumes. This volume (3) provides the complete Operational Description of the Experimental Loran Flight Following (LOFF) in the Houston Area. It describes both airborne and ground components and states the objectives that are being sought in the experiment. GRA

N81-10031# Federal Aviation Administration, Washington, D. C. Office of Aviation Policy.
HOURLY AIRPORT ACTIVITY PROFILES: 30 AIRPORTS BY USER, 3 AIRPORTS BY USER AND EQUIPMENT TYPE, SELECTED DAYS IN JUNE, JULY AND AUGUST, 1978
1980 156 p
(AD-A089450; FAA-AVP-80-7) Avail: NTIS HC A08/MF A01 CSCL 01/5

The first section of this report contains statistics on aircraft operations, by user category for 30 airports for selected days in June, July and August 1978. Using the series of tables and graphs on Atlanta as an example, the data should be interpreted as described in the following paragraphs. First, note that the data used for generating the statistics in the table included all operations occurring in Atlanta during August 1978. Local time in this case would be equivalent to eastern daylight time. Aircraft operations occurring between midnight and 1:00 a.m. are counted in time slot zero. Similarly, activity occurring between 12:00 noon and 1:00 p.m. is assigned to time slot 12:00. The second part of this report consists of six tables and seven graphs which portray total daily aircraft departures and average hourly aircraft departures by equipment type for three cities: Kansas City, Missouri; Omaha, Nebraska; and St. Louis, Missouri. This part of the report may be regarded as exploratory in nature. The tables and graphs provide, for the first time, information on departures by equipment type, by hour of the day. Previously, such information was available for air carrier operations at the top 100 air carrier airports. The information in this section includes operations by all user categories. GRA

N81-10032# Mitre Corp., McLean, Va.
ANALYSIS OF POTENTIALLY CORRECTABLE LANDING DELAYS AT ATLANTA
Bela P. Collins Nov. 1979 65 p refs
(Contract DOT-FA80WA-4370)
(AD-A089408; MTR-79W00415; FAA-EM-79-23) Avail: NTIS HC A04/MF A01 CSCL 17/7

The Local Flow Traffic Management order (DOT/FAA 7110.72), dated 15 November 1976, provided for the establishment of local procedures, at designated airports (16 initially), that would assist aircraft operators in minimizing fuel usage. These local procedures would be predicted on the aircraft performing a profile descent in conjunction with en route metering. This report presents the results of a field data collection and analysis of arrival traffic flows into the Atlanta-Hartsfield International Airport. The purpose of the analysis was to quantify the effect of traffic flow on runway utilization and to identify avoidable delays. Recommendations to improve the flow of traffic are also discussed. GRA

N81-10033# Naval Research Lab., Washington, D. C. Target Characteristics Branch.
NRL PARTICIPATION IN THE MICROWAVE LANDING SYSTEM PROGRAMS Summary Report
J. Paul Shelton and James K. Hsiao 19 Aug. 1980 107 p refs
(Contract DOT-FA75WAI-556)
(AD-A089168; NRL-MR-4305) Avail: NTIS HC A06/MF A01 CSCL 17/7

This report summarizes activity by the Radar Division of the Naval Research Laboratory in support of the Microwave Landing System program in the time period May 1975 through September 1979. This technical support was primarily associated with the ground scanning antennas. Initial emphasis was on microwave optical scanning techniques. This phase of the effort resulted in significant innovative contributions, but the more pressing objectives of the program shifted to the analysis of problems associated with phased array antennas. The Naval Research Laboratory contributed to the study of phased array in several ways. Computer simulations of internal monitoring systems, which can locate failed components, were carried out. A performance simulation of a general phased array using digital phase shifters was written. The performance characteristics of digital phase shifters were measured and statistically analyzed. Several research contracts for promising phased array techniques were awarded

to industrial contractors. In addition to research on the primary MLS functions, which involve scanning linear phased array antennas, NRL has studied the realization of a 360 degree scanning antenna utilizing a circular array. This report contains a nontechnical review of all activities, supported by technical appendices and a listing of reports and memoranda. GRA

N81-10034# IIT Research Inst., Annapolis, Md.
THE DISCRETE ADDRESS BEACON SYSTEM/AIR TRAFFIC CONTROL RADAR BEACON SYSTEM/ATCRBS IFF MARK 12 SYSTEM (DABS/ATCRBS/AIMS) PERFORMANCE PREDICTION MODEL Final Report
C. Randall Crawford and C. Wayne Ehler Apr. 1980 80 p refs
(Contracts F19628-78-C-0006; DOT-FA70WAI-175; AF Proj. 649E)
(AD-A089440; ECAC-PR-77-061; FAA-RD-79-88) Avail: NTIS HC A05/MF A01 CSCL 17/9

The Discrete Address Beacon System (DABS) is to be gradually phased into the existing Air Traffic Control Radar Beacon System (ATCRBS) in the 1980's. The DABS selective address feature is designed to alleviate the ATCRBS problems of over-interrogation and synchronous garble. The FAA requested that the Electromagnetic Compatibility Analysis Center (ECAC) develop a computer model with the capability to predict mutual interference arising in a mixed secondary-surveillance radar environment. The nature of the DABS interrogation schedule required that the model be a time-event store simulation. The model inputs are selected from the ECAC data base and consist of the characteristics of a ground and air deployment of sensors and transponders. Detailed characteristics of a sensor-of-interest (So) are among the inputs. The model output is primarily a record of the events that were predicted to occur during a simulation period. The performance of each transponder is described by its reply history during the time in which the equipped aircraft is in the So mainbeam. The fruit rate at the So is predicted, and the performance of the subject sensor is represented by the results of DABS transactions and ATCRBS target evaluations. Other summary outputs are available from the model, including interrogation rates, sidelobe suppression rates, and the identity of equipments that cause observable interference. GRA

N81-10035# Naval Surface Weapons Center, Dahlgren, Va. Space and Surface Systems Div.
A DERIVATION OF THE NONLINEAR PLATFORM ORIENTATION ERROR EQUATIONS FOR AN INS: WITH AN INTRODUCTION TO ROTATING COORDINATE FRAMES
Phillip L. Young Apr. 1980 20 p refs
(AD-A089263; NSWC/TR-80-104) Avail: NTIS HC A02/MF A01 CSCL 17/7

This report documents a derivation of the nonlinear platform orientation error equations for a local level inertial navigation system (INS). These differential equations govern the Euler angles that relate the actual orientation of the INS platform axes to the ideal orientation of these axes. The derivation deals with specific coordinate representations from the outset, by explicitly including the time-dependent transformations that relate the particular coordinate frames involved in the problem. Thus, the elements of the required angular velocity vectors are obtained in a very natural fashion, and the resulting equations incorporate the transformations needed to ensure computational consistency. A tutorial description of this approach to problems involving rotating coordinate frames is included in this report. GRA

N81-10036# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
PROPOSED ATC SYSTEM FOR THE GULF OF MEXICO: HELICOPTER OPERATIONS DEVELOPMENT PROGRAM Final Report
D. J. Freund and T. K. Vickers Nov. 1979 48 p
(Contract DOT-FA79WA-4279)
(AD-A089430; FAA-RD-80-85) Avail: NTIS HC A02/MF A01 CSCL 17/7

A helicopter ATC system for the Gulf of Mexico is set forth. It embodies a concept of evolutionary growth in four phases: (1) The Present System period of use 1980 - IFR navigation is obtained primarily with LoranC, or VLF/OMEGA. Back up systems are ADF and Airborne Weather Radar. VOR/DME is used over land. ACT is by procedural control ans separation standards because no radar or other surveillance system is available off shore; (2) LOFF Loran c Flight Following Period of Evaluation 1981 - The LOFF system is placed in operation for experimentation and evaluation. While ATC is still performed by procedural control, LOFF will assist ground controllers by reducing workload, improving flexibility, etc. Experiments will also be performed on secondary radar systems ATCRBS VLATME to provide surveillance: (3) Augmented LOFF Period of use 1983 and beyond - IFR helicopters will be able to fly direct, offset or segmented RNAV routes. ATC will be essentially equivalent to the NAS. Navigation by Loran C will expand. Surveillance will be by LOFF and/or secondary radar. Area of control will be 1,500 to 10,000 over entire Gulf, and 4 RNAV Traffic Control Period of use 1985 and beyond - IFR helicopters will be able to use any of a number of certified navigation systems. ATC systems will adapt to varying accuracies of these systems. ATC will be based on surveillance provided by aircraft reporting of position information and/or secondary radar. Separation standards will be reduced and be equivalent to Northeast Corridor. GRA

N81-10037# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
PRELIMINARY TEST PLANS OF ATC CONCEPTS FOR LONGER TERM IMPROVEMENT HELICOPTER DEVELOPMENT PROGRAM Final Report
D. J. Freund and Tirey K. Vickers May 1980 50 p refs
(Contract DOT-FA79WA-4279)
(AD-A089407; FAA-RD-80-87) HC A03/MF A01 CSCL 17/7

Test and simulation planning is documented for longer-term improvements in helicopter ATC concepts, which are classified into the following categories: (1) Offshore Route Structure in the Gulf of Mexico, (2) Secondary Radar, (3) Analysis of Navigation Errors in the Gulf, (4) Offshore Surveillance and Communications to 300 NM Range, (5) Real-Time Reporting of Aircraft-Derived Position, (6) VHF Communications Study in the CONUS, (7) ATC Implications of Alternate Airports for Helicopters, and (8) Wake Vortex Separation. GRA

N81-10038# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
RECOMMENDATIONS FOR SHORT-TERM SIMULATION OF ATC CONCEPTS. HELICOPTER OPERATIONS DEVELOPMENT PROGRAM Final Report
D. J. Freund and T. K. Vickers Feb. 1980 44 p
(Contract DOT-FA79WA-4279)
(AD-A089435; FAA-RD-80-86) Avail: NTIS HC A03/MF A01 CSCL 01/5

A number of recommendations from a previous helicopter air traffic control (ATC) study (See Report FAA-RD-78-150) were examined. Those which appeared to have potential for early implementation were selected for further testing. The selected recommendations included: (1) dual-fix holding patterns to save airspace; (2) speed control procedures and short approach paths to save fuel; (3) various methods of reducing separation in order to increase airport or heliport capacity. Under item 3 above, a rationale for utilizing existing parallel approaches of helicopters and CTOL aircraft was presented for consideration. Extensive use of flight simulation and ATC simulation was recommended in order to reduce the time and cost of evaluating the potential improvements. The steps of the recommended simulation program were arranged in the order of ascending cost, to learn as much as possible about the subject as quickly as possible and to weed out or revise impractical solutions before they reach a more expensive stage of evaluation or development. A detailed simulation program was prepared using a modified factorial design in order to isolate the effects of changes in various parameters. GRA

N81-10039# IIT Research Inst., Chicago, Ill.
IMPACT OF THE DISCRETE ADDRESS BEACON SYSTEM (DABS) ON AIR TRAFFIC CONTROL RADAR BEACON SYSTEM (ATCRBS) PERFORMANCE IN SELECTED DEPLOYMENTS Final Report
T. Keech and G. Fleming Apr. 1980 57 p refs
(Contract F19628-78-C-0006)

(AD-A089611; FAA-RD-80-93; ECAC-CR-79-127) Avail: NTIS HC A04/MF A01 CSCL 17/7

A computer analysis was conducted to investigate the effect of the proposed Discrete Address Beacon System (DABS) on the Air Traffic Control Radar Beacon System (ATCRBS) in a future (1982) Los Angeles, CA, air traffic environment. The performance of ATCRBS was examined at two sites, both with (a) the existing all-ATCRBS ground environment and (b) a mixed ATCRBS/DABS ground environment (using various levels of DABS channel activity). It was observed that, in general, DABS operations will not affect the ability of ATCRBS interrogators to perform their air traffic control function of reliably detecting aircraft. GRA

N81-10040# Analytical Systems Engineering Corp., Burlington, Mass.

NORTH ATLANTIC OMEGA NAVIGATION SYSTEM VALIDATION Final Report, 3 Aug. 1979 - 21 Jul. 1980

L. W. Campbell, T. M. Servaes, and E. R. Grassler 21 Jul. 1980 282 p refs

(Contract DOT-CG-903591-A)

(AD-A089615; ASECR-79-125; ONSOD-01-80) Avail: NTIS HC A13/MF A01 CSCL 17/7

The OMEGA Navigation System provides a worldwide enroute positioning capability from eight transmitting stations. Although the operational transmitting stations now provide useful navigation signals, the system will not be declared fully operational until the validation program is completed in 1985. The validation program is being accomplished on a regional basis through a measurement process conducted by the U.S. Coast Guard. The North Atlantic is the second region to be validated. The data base for the North Atlantic Validation consisted of LOP Phase measurements from 36 stations of the OMEGA Navigation System Operations Detail (ONSOD) worldwide monitor network and signal amplitude measurements, both ground and airborne, throughout the area collected by the Naval Ocean Systems Center (NOSC). These data were supplemented with integrated OMEGA/Satellite shipboard measurements and numerous OMEGA measurements and observations from ship and aircraft users, both civilian and military, from several countries. GRA

N81-10041# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

RECOMMENDED SHORT-TERM ATC IMPROVEMENTS FOR HELICOPTERS. VOLUME 1: SUMMARY OF SHORT TERM IMPROVEMENTS Final Report

Tirey K. Vickers and D. J. Freund Aug. 1980 48 p

(Contract DOT-FA79WA-4279)

(AD-A089521; FAA-RD-80-88-1) Avail: NTIS HC A03/MF A01 CSCL 17/7

A summary report is made of all improvements studied. Improvements are categorized as to those that can be recommended for immediate operational consideration or use and those that require limited short term simulation or test. The recommendations for immediate use include: (1) Helicopter ATC training material, (2) Operational Description of Loran Offshore Flight Following (LOFF), (3) Recommendations concerning military training routes and (4) Survey data for use in Gulf communications and route structure planning. The recommendations for short term simulation include: (1) Dual waypoint holding patterns, (2) other holding patterns and (3) shortened entry procedures for intercepting final approach path. GRA

N81-10042# Rome Air Development Center, Griffiss AFB, N.Y. Electromagnetic Sciences Div.

HECTIC: A LORAN GRID COMPUTATION PROGRAM FOR IRREGULAR TERRAIN

John L. Heckscher and Eli J. Tichovolsky Feb. 1980 52 p refs

(AF Proj. 450A)

(AD-A089497; RADC-TR-80-354) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report provides documentation for the computer program HECTIC which calculates LORAN time difference coordinates over rough terrain. Basic equations are given and the various terms are defined. The program system flow is outlined, and a User's Guide describes the input card, database tape, and printed output formats. A complete listing of the program is given. GRA

N81-10043# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Instrumentierung und Anthropotechnik.

ANALYSIS OF THE FUNCTION PRINCIPLE AND OPERATIONAL ASSESSMENT OF AN ONBOARD GLIDEPATH GUIDANCE SYSTEM FOR VISUAL APPROACHES (VISUAL APPROACH MONITOR (VAM)

Josef Thomas and Helmut Stein Oct. 1979 107 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-655)

(DFVLR-FB-79-38) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 20,00

The visual approach monitor, VAM, a head-up display system for manual approach was analyzed as regards its functioning principles and associated error characteristics. System simulations and flight tests were carried out with special emphasis on performance and stability studies. Experimental comparisons between VAM guided and unaided visual approaches revealed no significant advantages for VAM as far as flight path accuracy is concerned. However, VAM performed significantly better with regard to variances and extreme values for nearly all flight guidance parameters. Its overall performance was found to be comparable to that of the instrument landing system. Author (ESA)

N81-10044# Royal Aircraft Establishment, Farnborough (England).

CONTRIBUTIONS TO THE UNITED KINGDOM MICROWAVE LANDING SYSTEM RESEARCH AND DEVELOPMENT PROGRAM, 1974 TO 1978. VOLUME 1

J. M. Jones London HMSO May 1979 250 p refs 3 Vol. (RAE-TR-79052-Vol-1; RAE-RAD-NAV-Vol-1; BR73155) Avail: NTIS HC A11/MF A01

In support of the UK MLS program Doppler Microwave Landing System (DMLS) equipment operating on both frequency division and time division multiplex formats was extensively evaluated by means of analysis, ground and flight tests and hybrid simulation. Results show that the use of the Doppler technique leads to simple and reliable equipment with performance well inside the operational requirements. A full understanding of the possible environmental effects on system performance at 5 GHz was obtained. Author (ESA)

N81-10045# Royal Aircraft Establishment, Farnborough (England).

CONTRIBUTIONS TO THE UNITED KINGDOM MICROWAVE LANDING SYSTEM RESEARCH AND DEVELOPMENT PROGRAM, 1974 TO 1978. VOLUME 2

J. M. Jones London HMSO May 1979 168 p 3 Vol. (RAE-TR-79052-Vol-2; BR79052) Avail: NTIS HC A08/MF A01

In support of the UK MLS program, Doppler Microwave Landing System (DMLS) equipment operating on both frequency division and time division multiplex formats was extensively evaluated by means of analysis, ground and flight tests and hybrid simulation. Charts and figures pertaining to the following topics are presented: the Doppler MLS technique; basic data collection for ICAO submission; FDM system test results; and the time division multiplex system. Author (ESA)

N81-10046# Royal Aircraft Establishment, Farnborough (England).

CONTRIBUTIONS TO THE UNITED KINGDOM MICROWAVE LANDING SYSTEM RESEARCH AND DEVELOPMENT PROGRAM, 1974 TO 1978. VOLUME 3

J. M. Jones London HMSO May 1979 237 p 3 Vol. (RAE-TR-79052-Vol-3; BR79052) Avail: NTIS HC A11/MF A01

In support of the UK MLS program, Doppler Microwave Landing System (DMLS) equipment operating on both frequency division and time division multiplex formats was extensively evaluated by means of analysis, ground and flight tests and hybrid simulation. Charts and figures pertaining to the following topics are presented: the Doppler simulator and time division multiplex bench measurements; flight trials results of the TDM system; field trials at operational airports; and a reference-less system. Author (ESA)

N81-10047# European Space Agency, Paris (France).
ON THE ACCURACY IMPROVEMENT OF INCREMENTAL READOUT TECHNIQUES FOR INERTIAL SENSORS Ph.D. Thesis - Technische Univ., Brunswick
Dietrich Rahlfs Nov. 1979 149 p refs Transl. into ENGLISH of "Zur Genauigkeitssteigerung Inkrementeller Ausleseverfahren fuer Traegheitssensoren", Rept. DLR-FB-77-70 DFVLR, Brunswick, Apr. 1978 Original report in GERMAN previously announced as N79-30170
(ESA-TT-573; DLR-FB-77-70) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 60,80

Incremental feedback techniques offer digital readout for inertial sensors with high solution. A binary pulse width modulated quantizer is analyzed and an incremental feedback loop is synthesized. The accuracy of the readout depends on the time stability of the feedback time current pulses. A generator of high precision time current pulses is investigated and the readout technique is applied to three types of pendulous accelerometers. Relative stability of better than 1/1,000,000 per day was obtained. Suggestions for further improvement of readout techniques for inertial sensors are given. This technique can be applied in general to any current feedback sensor with integrating behavior. Author (ESA)

N81-10048# New England Research Application Center, Storrs, Conn.
ADIABATIC GAS FLOW. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Apr. 1980
Robert Hippler May 1980 167 p Sponsored in part by NTIS
(PB80-808546) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

Adiabatic gas flows for planetary and stellar atmospheres, aerodynamics, heat transfer, nozzles, turbines, and energy systems, such as magnetohydrodynamics and fusion reactors are discussed in approximately 76 citations. Analytical and modeling techniques, characteristics, experimental data, and fundamental principles are covered. Two and three dimensional, compressible and incompressible gas dynamic flows, for unbounded and bounded, stable and unstable conditions are included. GRA

N81-10049*# New England Research Application Center, Storrs, Conn.
HEAD UP DISPLAYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Apr. 1980
Robert Hippler May 1980 80 p Sponsored by NASA and NTIS
(NASA-CR-163656; PB80-809072) Avail: NTIS HC $30.00/MF $30.00 CSCL 01D

Head up displays are the subject of this retrospective survey of much of the world aerospace literature. Design, fabrication and use, and applications to specific aircraft, such as the F-4E, Jaguar, Tornado, F-18, Viggin, A-10, AV-8B, Sea Harrier, Space Shuttle, helicopters, KC-135S, and in commercial aircraft, are discussed. A look at the future in this field is also presented. Contains 70 citations. GRA

N81-10050# New England Research Application Center, Storrs, Conn.
HEAD UP DISPLAYS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Apr. 1980
Robert Hippler May 1980 133 p Sponsored in part by NTIS
(PB80-809064) Avail: NTIS HC $30.00/MF $30.00 CSCL 01D

Design, fabrication and use, and applications to specific aircraft, such as the F-4E, Jaguar, Tornado, F-18, Viggin, A-10, AV-8B, Sea Harrier, Space Shuttle, helicopters, KC-1358, and in commercial aircraft, are discussed. A look at the future in this field is also presented. GRA

N81-10051# New England Research Application Center, Storrs, Conn.
CRYOGENIC AGING OF METALS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1980
C. Gilbert Young May 1980 134 p Sponsored in part by NTIS
(PB80-808876) Avail: NTIS HC $30.00/MF $30.00 CSCL 01D

Deterioration, or failure, of metals at low temperatures is discussed. Cryogenic operations, superconductors, aircraft, arctic facilities and other forms of exposute of metals to extreme cold are included. Failure mechanisms, dynamics, and inhibitors or retardants, are described. GRA

N81-10052*# New England Research Application Center, Storrs, Conn.
CRYOGENIC AGING OF METALS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1975 - Apr. 1980
C. Gilbert Young May 1980 130 p Sponsored by NASA and NTIS
(NASA-CR-163657; PB80-808884) Avail: NTIS HC $30.00/MF $30.00 CSCL 01D

These citations discuss the deterioration, or failure, of metals at low temperatures. Aluminum is not included, as it is the subject of a separate retrospective bibliography. Cryogenic operations, superconductors, aircraft, arctic facilities and other forms of exposure of metals to extreme cold, are included. Failure mechanisms, dynamics, and inhibitors or retardants, are described. Contains 137 citations. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-10053 Engineering Sciences Data Unit, London (England).
THE USE OF DATA ITEMS ON AIRCRAFT PERFORMANCE MEASUREMENT
1980 9 p Supersedes ESDU-75017
(ESDU-80009; ESDU-75017; ISBN-0-85679-292-6) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161

The purpose of flight testing and the principles that govern the methods of processing the data obtained, are explained to show the interrelationship between the various items that treat particular aspects and to indicate how methods not currently discussed in the items might be applied. The processing of flight test data obtained from aircraft with turbofan, turbojet, turboprop, or piston engines are described. ESDU (GRA)

N81-10054*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE XV-15 TILT ROTOR RESEARCH AIRCRAFT
Daniel C. Dugan, Ronald G. Erhart (Bell Helicopter Textron, Fort Worth, Tex.), and Laurel G. Schroers (AVRADCOM) Sep. 1980 21 p refs Prepared in cooperation with AVRADCOM
(NASA-TM-81244; AVRADCOM-TR-80-A-15; A-8343) Avail: NTIS HC A02/MF A01 CSCL 01C

The design characteristics of the XV-15 Tilt rotor research aircraft are presented. Particular attention is given to the following: control system; conversion system; and propulsion system. Flight test results are also reported. R.C.T.

N81-10055# McDonnell Aircraft Co., St. Louis, Mo.
AIRCRAFT HYDRAULIC SYSTEMS DYNAMIC ANALYSIS. VOLUME 6: STEADY STATE FLOW ANALYSIS SSFAN COMPUTER PROGRAM TECHNICAL DESCRIPTION Final Technical Report, Jun. 1978 - Nov. 1979
Ray Levek and Bob Young Wright-Patterson AFB AFAPL Apr. 1980 339 p refs Revised
(Contract F33615-74-C-2016)
(AD-A089240; AFAPL-TR-76-43-Vol-6) Avail: NTIS HC A15/MF A01 CSCL 01/3

SSFAN is a steady state hydraulic flow and pressure analysis computer program. Its primary purpose is to analyze non-linear resistance aircraft hydraulic systems. The program handles complex flow networks containing flow and/or pressure discontinuities such as unbalanced area actuators and check valves. Solutions for a combination of simultaneously operating sub-

systems are easily obtained. The program is designed using a building block approach so that new component or element models may be added with minimum change to the main program. The solution method is a matrix type, using iteration to obtain a final flow and pressure balance. The program internally corrects viscosities for pressure, determines whether flow is laminar, transition or turbulent for use of appropriate resistance factors and corrects reservoir pressure for altitude effects. A quasi-transient section has been added to allow multiple steady state calculations when simulating subsystem operations. The data is stored and can be printed in either tabular form or computer plot form. The program was written with the aircraft hydraulic system designer in mind. The terminology and units are commonly used terms such as fluid viscosity in centistokes, temperatures in degrees Fahrenheit and flow in gallons per minute. Conversion of units for calculation is accomplished internally in the program. GRA

N81-10056# Lockheed-Georgia Co., Marietta. Advanced Concepts Dept.
DESIGN OPTIONS STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
W. T. Mikolowsky, L. W. Noggle, H. J. Abbey, L. A. Adkins, and H. A. Bricker Sep. 1980 27 p
(Contract F33615-78-C-0122)
(AD-A089536; LG80ER0006-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 01/3

The Advanced Civil/Military Aircraft ACMA is envisioned as an advanced technology cargo aircraft with the potential for fulfilling the needs of both military airlift and commercial air freight in the 1990's and beyond. The ultimate goal of the Design Options Sudy is the development of fundamental information regarding both the military and commercial cost and effectiveness implications of the most significant transport aircraft functional design features. This volume, the Executive Summary of the Design Options Study Final Report, presents an overview of the requirements of potential users of the ACMA and a brief summary of the results of the study. GRA

N81-10057# Lockheed-Georgia Co., Marietta. Advanced Concepts Dept.
DESIGN OPTIONS STUDY. VOLUME 2: APPROACH AND SUMMARY RESULTS Final Report
W. T. Mikolowsky, L. W. Noggle, H. J. Abbey, L. A. Adkins, and H. A. Bricker Sep. 1980 177 p refs
(Contract F33615-78-C-0122)
(AD-A089537; LG80ER0007-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 01/3

Background information for the requirement for the advanced civil military aircraft (ACMA) is given and the approach used to investigate transport aircraft design options is described. The initial qualitative assessment used to reduce the scope of the study and the results of the detailed analyses are summarized. These results include estimates of the effects on aircraft geometry and efficiency, military effectiveness, and both civil and military costs for incorporating in the ACMA each of the design options identified in the qualitative assessment. GRA

N81-10058# Lockheed-Georgia Co., Marietta. Advanced Concepts Dept.
DESIGN OPTIONS STUDY. VOLUME 3: QUALITATIVE ASSESSMENT Final Report
W. T. Mikolowsky, H. J. Abbey, L. A. Adkins, H. A. Bricker, and E. W. Caldwell Sep. 1980 177 p refs
(Contract F33615-78-C-0122)
(AD-A089538; LG80ER0008-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 01/3

All functional design features and associated options that have a potential impact on military/commercial commonality of the advanced civil military aircraft are qualitatively assessed. Functional areas considered include basic aircraft performance, ground interface, airfield compatibility, cargo compartment, inflight refueling, personnel accommodations, and military/civil design criteria. Based on this assessment, the following features are recommended for further analysis: design payload, loading/unloading apertures, planform shape of the cargo compartment, floor height, takeoff distance/gear flotation, noise characteristics/engine-out climb gradient, cargo-envelope maximum height, passenger provisions, maximum structural payload, service life specifications, cargo compartment pressurization, and cargo accommodation provisions. GRA

N81-10059# Lockheed-Georgia Co., Marietta. Advanced Concepts Dept.
DESIGN OPTIONS STUDY. VOLUME 4: DETAILED ANALYSES SUPPORTING APPENDICES Final Report
W. T. Mikolowsky, H. J. Abbey, L. A. Adkins, H. A. Bricker, and E. W. Caldwell Sep. 1980 202 p refs
(Contract F33615-78-C-0122)
(AD-A089539; LG80ER0009-Vol-4) Avail: NTIS HC A10/MF A01 CSCL 01/3

Nonproprietary information and study methods are presented. The baseline aircraft that serves as the basis for the qualitative assessment is described, as well as the computer methods used to assist in the redesign of aircraft incorporating each design option. GRA

N81-10060# Naval Postgraduate School, Monterey, Calif.
THE USE OF PARAMETRIC COST ESTIMATING RELATIONSHIPS AS THEY PERTAIN TO AIRCRAFT AIRFRAMES: A NEW PERSPECTIVE M.S. Thesis
Bruce Robert Bennett Mar. 1980 47 p refs
(AD-A089525) Avail: NTIS HC A03/MF A01 CSCL 14/1

The purpose of this thesis was to review cost estimating relationships that have been developed and used for aircraft airframe costs, to identify existing problems, and where appropriate, to suggest alternatives for the future application of cost estimating relationships to aircraft airframes. Mahalanobis distance was explored as a means of complementing the more traditional statistical measures for regression analysis. This study supports the conclusion that cost estimating relationships should be developed for a specific system to be estimated, and that Mahalanobis distance is a potentially effective tool by which the analyst may address the important issue of analogy between the data base and the proposed system. GRA

N81-10061# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
PRELIMINARY AIRWORTHINESS EVALUATION AH-1S HELICOPTER WITH OGEE TIP SHAPE ROTOR BLADES Final Report, Nov. 1979 - Apr. 1980
Gary L. Bender, Henry Arnaiz, David Ottomeyer, Ralph Woratschek, Larry Higgins, and John S. Tulloch May 1980 40 p refs
(AD-A089625; USAAEFA-77-25) Avail: NTIS HC A03/MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a Preliminary Airworthiness Evaluation of the AH-1S helicopter with OGEE tip-shape main rotor blades to determine if any improvement in performance or handling qualities resulted from replacing the K747 blades. Additionally, the acoustics signature of the OGEE blades were measured by the US Army Research and Technology Laboratories (Aeromechanics Lab). Tests were conducted at Edwards Air Force Base (elevation 2302 feet) and Coyote Flats (elevation 9980 feet), California from 1 November 1979 through 8 April 1980. Forty-five test flights were flown for a total of 36.6 productive hours (63.2 total hours). Both hover and level flight performance were degraded by installation of OGEE tip-shape main rotor blades. Low-speed handling qualities were unaffected by the OGEE blades. Other handling qualities tests were not accomplished. Results of acoustics tests will be reported by the laboratories under a separate cover. GRA

N81-10062# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flaechenflugzeuge.
AN ANALYTICAL STUDY OF LANDING FLARE
Guenther Knorr and Knut Wilhelm Sep. 1979 77 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-656)
(DFVLR-FB-79-40) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 15,20

The relation between landing flare and the specific dynamic characteristics of an aircraft as studied. A simple behavioral law is used to obtain analytical solutions for state variables. Both conventional flare maneuver operations and coupled control

operations are investigated. The effects of wind shear on landing flare are also demonstrated. Analytical solutions applicable to a transport aircraft are discussed; these solutions lead to a definition of the time range for flare initiation. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N81-10063# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.

OPTIMIZED COMPUTER SYSTEMS FOR AVIONICS APPLICATIONS Final Technical Report, 1 Feb. - 30 Sep. 1979

R. T. Chien and L. J. Peterson Feb. 1980 175 p refs

(Contract F33615-78-C-1559; AF Proj. 2003)

(AD-A089570; AFAL-TR-79-1235) Avail: NTIS HC A08/MF A01 CSCL 09/5

The main purpose of this project is to investigate the commonalities among the four subareas of signal processing, namely, radar, communications, image processing and electronic warfare; and to establish possible common functional descriptions as the basis for a common architecture. An extensive search was made to list all important kernels and algorithms in radar, communications and image processing. These kernels and algorithms were carefully analyzed with respect to their computational complexity and identification of commonality for architectural purposes. It was discovered that significant commonalities do exist in many areas. These common areas represent significant overlap and commonality which can be utilized in a common architecture. GRA

N81-10064# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

SYSTEM SIMULATION APPLIED TO THE EVALUATION OF DISPLAYS FOR GUIDANCE AND CONTROL

Uwe Teegen (Technische Univ., Brunswick) Jun. 1979 62 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-659)

(DFVLR-Mitt-79-10) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 12,60

The development of displays for monitoring and controlling complex technical systems is facilitated by employing a computer simulation of the man-machine system during the theoretical design phase. A simulation model for the manual control task is described which leads to a method for evaluating displays. The capabilities and applications of this simulation model to a pilot airplane system restricted to aircraft motion in the vertical plane and a two channel pilot mode are presented. The results obtained suggest that the model should be further developed.

Author (ESA)

N81-10065*# New England Research Application Center, Storrs, Conn.

GYROCOMPASSES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1972 - Apr. 1980

C. Gilbert Young May 1980 165 p Sponsored by NASA and NTIS

(NASA-CR-163675; PB80-809023) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

Research on gyrocompasses and related areas, such as navigation, inertial navigation, gyrocompass design and construction, and gyrocompass systems is reported. Kalman and other types of electronic systems used in conjunction with the basic gyrocompass unit are also considered. Strap down systems are discussed. This bibliography contains 186 abstracts. GRA

N81-10066# New England Research Application Center, Storrs, Conn.

GYROCOMPASSES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Apr. 1980

C. Gilbert Young May 1980 38 p Sponsored in part by NTIS

(PB80-809015) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

These abstracts are on the subject of gyrocompasses and related areas, such as navigation, inertial navigation, gyrocompass design and construction, and gyrocompass systems. The 35 citations include some on Kalman and other types of electronic systems used in conjunction with the basic gyrocompass unit. Strap down systems are discussed. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N81-10067*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPARISONS OF FOUR ALTERNATIVE POWERPLANT TYPES FOR FUTURE GENERAL AVIATION AIRCRAFT

T. J. Wickenheiser, G. Knip, R. M. Plencner, and W. C. Strack Oct. 1980 50 p refs

(NASA-TM-81584; E-561) Avail: NTIS HC A03/MF A01 CSCL 21E

Recently completed NASA sponsored conceptual studies were culminated in the identification of promising new technologies for future spark ignition, diesel, rotary, and turbine engines. The results of a NASA in-house preliminary assessment study that compares these four powerplants types in several general aviation applications are reported. The evaluation consisted of installing each powerplant type in rubberized aircraft which are sized to accomplish fixed missions. The primary evaluation criteria include projected aircraft cost, total ownership cost, and mission fuel.

Author

N81-10068# General Electric Co., Lynn, Mass. Aircraft Engine Group.

MARITIME PATROL AIRCRAFT ENGINE STUDY. GENERAL ELECTRIC DERIVATIVE ENGINES. VOLUME 2: APPENDIX A. PERFORMANCE DATA - GE27/T3 STUDY A1 TURBOPROP Final Report, Oct. 1978 - Apr. 1979

R. Hirschkron, R. H. Davis, and R. E. Warren 30 Apr. 1979 81 p

(Contract N62269-78-C-0414)

(AD-A089336; R79AEG052-Vol-2; NADC-79133-60-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 21/5

This study developed data on General Electric common core derivative engines for use in Maritime Patrol Aircraft (MPA) concept formulation studies. The study included the screening of potential General Electric turbofan and turboprop/turboshaft engines and the preparation of technical and planning information on three of the most promising engine candidates. Screening of General Electric derivative candidates was performed utilizing an analytical MPA model using synthesized mission profiles to rank the candidates in terms of fuel consumption, weight, cost and complexity. The three turboprop engines selected for further study were as follows: TF34 growth derivative version with boost and new LPT (TF34/T7 Study A1), F404 derivative with booster stages and new LPT (F404/T1 Study A1), and GE27 scaled and boosted study engine (GE27/T3 Study A1). Volume 1 summarizes the screening analysis and contains technical, planning, installation, cost and development data for the three selected turboprop engines. Volumes 2, 3 and 4 of this report contain the detailed performance data estimates for the GE27/T3 Study A1, TF34/T7 Study A1 and F404/T1 Study A1 turboprop engines, respectively. GRA

N81-10069# General Electric Co., Lynn, Mass. Aircraft Engine Group.

MARITIME PATROL AIRCRAFT ENGINE STUDY. GENERAL ELECTRIC DERIVATIVE ENGINES. VOLUME 3: AP-

PENDIX B. PERFORMANCE DATA - TF34/T7 STUDY A1 TURBOPROP Final Report, Oct. 1978 - Apr. 1979
R. Hirschkron, R. H. Davis, and R. E. Warren 30 Apr. 1979 81 p
(AD-A089279; R79AEG052-Vol-3; NADC-79133-60-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 21/5

This study developed data on General Electric common core derivative engines for use in Maritime Patrol Aircraft (MPA) concept formulation studies. The study included the screening of potential General Electric turbofan and turboprop/turboshaft engines and the preparation of technical and planning information on three of the most promising engine candidates. Screening of General Electric derivative candidates was performed utilizing an analytical MPA model using synthesized mission profiles to rank the candidates in terms of fuel consumption, weight, cost and complexity. The three turboprop engines selected for further study were as follows: TF34 growth derivative version with boost and new LPT (TF34/T7 Study A1), F404 derivative with booster stages and new LPT (F404/T1 Study A1), and GE27 scaled and boosted study engine (GE27/T3 Study A1). Volume 1 summarizes the screening analysis and contains technical, planning, installation, cost and development data for the three selected turboprop engines. Volumes 2, 3 and 4 of this report contain the detailed performance data estimates for the GE27/T3 Study A1, TF34/T7 Study A1 and F404/T1 Study A1 turboprop engines, respectively. GRA

N81-10070# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ANALYSIS OF AIR FORCE MANAGEMENT OF TURBINE ENGINE MONITORING SYSTEMS (TEMS) M.S. Thesis
Elbert B. Hubbard, III and Gregory A. Swecker Jun. 1980 118 p refs
(AD-A089365; AFIT-LSSR-68-80) Avail: NTIS HC A06/MF A01 CSCL 21/5

Turbine Engine Monitoring Systems (TEMS) are engine health monitoring and diagnostic tools being developed and tested for use on Air Force engines in order to improve and reduce the cost of engine maintenance and management and to aid in the implementation of On Condition Maintenance. Previous researchers have described the major features of TEMS, analyzed the results of development and test efforts, and identified problems which must be overcome. This study examines the problem of fragmentation which exists in the Air Force management of TEMS development and testing. The authors describe and analyze the overall Air Force management of TEMS. Management problems were identified and classified into three major areas: structure and role problems, information flow and integration problems, and leadership and command problems. Four alternative management concepts were analyzed. Based on this analysis, the authors recommend that the management structure be modified, and a TEMS Task Force be established to more effectively utilize TEMS for Air Force engine maintenance and management. GRA

N81-10071# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Division.
EVALUATION OF CRACK GROWTH IN ADVANCED P/M ALLOYS Final Report, 1 Sep. 1977 - 30 Jun. 1979
David L. Sims and F. Conrad Haake Wright-Patterson AFB, Ohio AFML Mar. 1980 108 p refs
(Contract F33615-77-C-5093; AF Proj. 2420)
(AD-A089296; PWA-FR-12126; AFML-TR-79-4160) Avail: NTIS HC A06/MF A01 CSCL 11/6

This program evaluates the crack growth characteristics of the advanced P/M alloy AF2-1DA. An interpolative model, developed in an earlier program, is used to describe crack growth properties at various conditions. Results are presented, including applicability of linear elastic mechanics (LEFM) and the effects of frequency, stress ratio, and temperature on crack propagation rates. GRA

N81-10072# AiResearch Mfg. Co., Phoenix, Ariz.
COMPOUND CYCLE TURBOFAN ENGINE (CCTE). TASK 9: CARBON-SLURRY FUEL COMBUSTION EVALUATION PROGRAM Final Report, Jun. - Sep. 1979
T. W. Bruce and H. Mongia Mar. 1980 101 p refs
(Contract F33657-77-C-0391)
(AD-A089451; Rept-21-3365-A; AFWAL-TR-80-2035) Avail: NTIS HC A06/MF A01 CSCL 21/4

The carbon slurry fuel evaluation program demonstrated the feasibility of running a currently available carbon slurry fuel in a combustion rig and a turbine engine. This program also established the preliminary design criteria for operating on carbon slurry fuels. Subcontracts work was performed by Pennsylvania State for fuel droplet measurements and by Suntech, Inc. for fuel development and manufacture. GRA

N81-10073# Detroit Diesel Allison, Indianapolis, Ind.
FUEL CHARACTER EFFECTS ON CURRENT, HIGH PRESSURE RATIO, CAN-TYPE TURBINE COMBUSTION SYSTEMS Final Report, Jun. 1978 - Jun. 1979
Rodney E. Vogel, Dennis L. Troth, and Albert J. Verdouw Wright-Patterson AFB, Ohio AFAPL Apr. 1980 163 p refs
(Contract F33615-78-C-2006; AF Proj. 3048)
(AD-A089182; DDA-EDR-9762; AFAPL-TR-79-2072; AFESC/ESL-TR-79-29) Avail: NTIS HC A08/MF A01 CSCL 21/4

The effect of limited fuel property variation on the performance of current, high pressure ratio, can type combustors was evaluated. The TF41 turbofan combustor was employed. This combustor has conventional, dual orifice fuel injection and film cooling. The combustion zone is approximately stoichiometric at takeoff. Twelve experimental fuels, including JP-4 and JP-8, were tested. Distillation range, hydrogen content, and aromatic type were varied by blending JP-4 and JP-8 fuels with mineral seal oil and two types of aromatic solvents. Performance tests were accomplished at idle, altitude cruise, dash, and takeoff conditions. Sea level altitude ignition tests were also completed. Fuel fouling and carboning characteristics were established. Combustor operating parameters such as linear temperature, pattern factor, ignition fuel/air ratio, lean blow out fuel/air ratio, and exhaust emissions were correlated to fuel properties. The effect of fuel properties on combustor and turbine hardware durability was assessed analytically. GRA

N81-10074# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
DISK RESIDUAL LIFE STUDIES. PART 2: TF30 10TH-STAGE COMPRESSOR DISK (INCOLOY 901) Final Report, 1 Apr. 1976 - 30 Jun. 1979
J. S. Cargill, J. K. Malpani, and Y. W. Cheng Dec. 1979 96 p refs
(Contract F33615-76-C-5172; AF Proj. 7351)
(AD-A089524; PWA-FR-11878-Pt-2; AFML-TR-79-4173-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 21/5

A residual fatigue life prediction method, suitable for retirement for cause application, has been developed for two p WA turbine disks the F100 1st-stage high pressure turbine disk and the TF30 10th-stage compressor disk. The method is based upon interaction of fracture mechanics crack propagation modeling concepts with laboratory nondestructive evaluation NDE hyperbolic sine SINH model refined during an earlier Air Force Materials Laboratory AFML program. Stress intensity K solution for the eingine components were based upon experimental effective K determinations made during full-scale component fatigue tests. The NDE techniques developed for disk inspections included acoustic emission AE, eddy current EC, and fluorescent penetrants FP. Stress-enhanced penetrant and semi-automated rotating probe EC techniques were developed as periodic inspections, while the AE time-domain technique was developed as a real-time inspection tool. GRA

N81-10075# Rolls-Royce Ltd., Derby (England).
QUANTITATIVE THERMOGRAPHY IN AERO-ENGINE RESEARCH AND DEVELOPMENT
M. Hilton 1980 21 p
(PNR-90021) Avail: NTIS HC A02/MF A01

The use of a recording thermograph to study an engine exhaust unit which is suspected of having thermal gradients of sufficient severity to cause local distortion is described. Temperature measurements obtained from color contoured thermograms are compared with thermocouples embedded in the exhaust unit. The data processing and analysis techniques are described together with the problems encountered when correlating the Thermovision results with those obtained from the thermocouples. Reasons

for the discrepancies are discussed with an assessment of the problem magnitude and possible means of overcoming them in future applications. Author (ESA)

N81-10076# New England Research Application Center, Storrs, Conn.

AXIAL FLOW COMPRESSORS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1980

Robert Hippler May 1980 140 p Sponsored in part by NTIS (PB80-808611) Avail: NTIS HC $30.00/MF $30.00 CSCL 21E

Axial flow compressors used in jet engines, gas turbines, turbo fans, ultra centrifuges and other turbomachinery are discussed in approximately 123 citations. Design, blades and rotors, materials, flow measurement, performance and applications are included. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-10077*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A PILOTED SIMULATOR INVESTIGATION OF STATIC* STABILITY AND STABILITY/CONTROL AUGMENTATION EFFECTS ON HELICOPTER HANDLING QUALITIES FOR *INSTRUMENT APPROACH

J. V. Lebacqz, R. D. Forrest, and R. M. Gerdes Sep. 1980 393 p refs

(NASA-TM-81188; FAA-RD-8064; A-8125) Avail: NTIS HC A17/MF A01 CSCL 01C

A motion base simulator was used to compare the flying qualities of three generic single rotor helicopters during a full attention to flight control task. Terminal area instrument approaches were flown with and without turbulence. The turbulence of helicopter static stability was investigated in terms of the values of cockpit control gradients as specified in the existing airworthiness criteria. The effectiveness of several types of stability control augmentation systems in improving the instrument flight rules capability of helicopters with reduced static stability was examined. Two levels of static stability in the pitch, roll, and yaw axes were examined for a hingeless rotor configuration; the variations were stable and neutral static stability in pitch and roll, and two levels of stability in yaw. For the lower level of static stability, four types of stability and control augmentation were examined for helicopters with three rotor types: hingeless, articulated, and teetering. S.F.

N81-10078# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Flaechenflugzeuge.

FLIGHT TEST RESULTS OF THE HFB 320 MODEL FOLLOWING *CONTROL SYSTEM FOR THE IN-FLIGHT SIMULATION* OF AIRBUS A 130

Sep. 1979 76 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-660)

(DFVLR-Mitt-79-13) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 15,40

The programming of the airborne computer is discussed. The effects on nonlinearities were demonstrated from the results of ground-based simulation of the test aircraft, model and control system. The high quality of the A 310 model aircraft simulation is confirmed from the flight-test results obtained. Examples are presented in which the ground based simulation technique is used to predict flight test results. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also 14 Ground Support Systems and Facilities (Space).

N81-10079# Naval Construction Battalion Center, Port Hueneme, Calif.

FIBERGLASS-REINFORCED RIGID POLYURETHANE EXPEDIENT PAVEMENT SUBJECT TO SIMULATED F-4 AIRCRAFT TRAFFIC

P. S. Springston May 1980 65 p refs

(YF53536091)

(AD-A089266; CEL-TN-1578) Avail: NTIS HC A04/MF A01 CSCL 11/2

A multipurpose expedient paving system is being developed to enable more rapid construction of expeditionary airfields by Marine Corps forces engaged in an amphibious landing. Previous research has resulted in a conceptual pavement, FIBERMAT, which consists of a facing of fiberglass-reinforced polyester resin (FRP) bonded to a core of fiberglass-reinforced rigid polyurethane foam. FIBERMAT has been subjected to a series of laboratory tests to define response to stress fatigue and environmental cycling. A similar structural sandwich of FRP and rigid polyurethane foam has been tested and found to meet F-4 aircraft static load, tailhook impact, and engine exhaust blast requirements. This report documents the results of a traffic test conducted on a section of FIBERMAT having a 5 inch thick fiberglass-reinforced foam core and a 1/4 inch thick FRP facing. Distributed traffic was applied to the test section with a load cart which simulated a main gear of an F-4 aircraft. The cart was equipped with a 30-7.7, 18 plyrating tire inflated to 265 psi and loaded to 27,000 pounds. The first failure within the test section was recorded at 136 coverages (1,306 passes) of the load cart, and the entire test section was considered failed at 310 coverages (2,141 passes). GRA

N81-10080# Battelle Columbus Labs., Ohio.

POLYMER RESEARCH IN RAPID RUNWAY REPAIR *MATERIALS* Final Report, Jan. - Oct. 1979

Manfred Luttinger, Charles W. Kistler, Jr., Henry M. Grotta, and Richard G. Sinclair Tyndall AFB, Fla. *Air Force Engineering and Service Lab.* Nov. 1979 93 p refs

(Contract F08635-79-C-0040)

(AD-A089606; AFESC/ESL-TR-79-43) Avail: NTIS HC A05/MF A01 CSCL 11/1

Low viscosity, two-component epoxy resins were formulated for airless spray application over quartz or dolomite aggregates. The formulation selected for full evaluation was based on mercaptan curing systems. Trifunctional acrylate monomers were used in some formulations as modifiers. The resulting polymer concrete set up within 3 to 4 minutes after mixing at temperatures around 73 degrees F. Good cures within 1/2 hour of mixing can be obtained in wet environments down to 5 degrees C and in dry environments down to -25 degrees C. Good adhesion to wet aggregates requires the use of coupling agents, organofunctional silanes being preferred. Good bonding to asphalt and Portland cement concrete and good wear characteristics were demonstrated. Flexural strength properties are satisfactory after cool down both under dry and wet application conditions. While the polymer concrete is hot due to the exotherm of the curing reaction, flexural strength properties are low. GRA

N81-10081# Systems Research Labs., Inc., Dayton, Ohio. Aerosystems Group.

AIRCRAFT ENGINE NACELLE FIRE TEST SIMULATOR. VOLUME 1: TECHNICAL Final Report, Sep. 1976 - Apr. 1980

Karlheinz O. W. Ball, Dennis B. Burnsides, Rolf D. Hegele, and Paul R. Hughes Apr. 1980 81 p

(Contract F33615-76-C-2084; AF Proj. 3048)

(AD-A089629; AFWAL-TR-80-2055-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 14/2

This report describes the design, installation, and initial

checkout of the Aircraft Engine Nacelle Fire Test Simulator. This facility was designed to realistically reproduce the environments and combustion related phenomena encountered within an engine nacelle. The facility provides both heating and cooling of the inlet air, heating of the engine case, control of air velocity and air pressure, and for the injection of fluids, combustibles or extinguishants. The report presents the final implementation of the system and details the hardware installation, the control system, and the software needed to provide integrated control, safety, and data acquisition. Only limited checkout was possible due to the failure of the air compression and the cleaning and modification efforts required to return the system to a safe operating level. GRA

N81-10082# Southampton Univ. (England).
A LONG STROKE ISENTROPIC FREE PISTON HYPERSONIC WIND TUNNEL
R. A. East and A. M. S. Qasrawi London Aug. 1978 48 p refs Supersedes AASU-334; ARC-37889
(ARC-R/M-3844; BR73234; AASU-334; ARC-37889) Avail: NTIS HC A03/MF A01; HMSO £10 PHI

The application of a long stroke isentropic free piston compressor as the energy source for an intermittent M = 6.85 hypersonic wind tunnel is described. The advantages of comparatively long running times of up to 0.5 sec and uniform reservoir conditions at up to 90 bar and 600 K are discussed. Particular problems arising from the long stroke compression associated with both viscous flow effects and nonsteady wave propagation are examined and solutions suggested. The theoretical operating principles of long stroke compression tubes are presented and experimental results are given for a pilot facility with compression tube diameter of 0.032 m and length to diameter ratio of 120 and for a full scale facility with corresponding values of 0.11 m and 114. Author (ESA)

N81-10083# National Technical Information Service, Springfield, Va.
***AIRFIELD PAVEMENT EVALUATION. CITATIONS FROM* THE NTIS DATA BASE Progress Report, Jul. 1975 - Jun. 1980**
Guy E. Habercom, Jr. Jul. 1980 211 p Supersedes NTIS/PS-79/0754; and NTIS/PS-78/0685
(PB80-812860; NTIS/PS-79/0754; NTIS/PS-78/0685) Avail: NTIS HC $30.00/MF $30.00 CSCL 01E

The bibliography contains abstracts of Government sponsored research reports relative to airfield pavement structures. Durability, wear resistance, skid resistance and surface qualities are analyzed and evaluated. This updated bibliography contains 202 citations, 12 of which are new entries to the previous edition. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-10084*# National Aeronautics and Space Administration, Washington, D. C.
MISSION OPERATION REPORT: FLTSATCOM-D LAUNCH
30 Oct. 1980 22 p
(NASA-TM-82218; M-O-491-202-80-80-04) Avail: NTIS HC A02/MF A01 CSCL 22A

FLTSATCOM is an advanced Earth satellite designed to provide extensive communication capability for the USAF and USN. The satellites are to be placed in synchronous, near equatorial orbits and provide 23 UHF and one SHF channels. Mission objectives, mission description, spacecraft description, launch vehicle configuration, and organization and responsibilities are described. L.F.M.

N81-10934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECENT SOUNDING ROCKET HIGHLIGHTS AND A CONCEPT FOR MELDING SOUNDING ROCKET AND SPACE SHUTTLE ACTIVITIES
J. H. Lane and E. E. Mayo *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 121-132 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10935# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Systemtechnik.
THE EVOLUTION OF PAYLOAD SYSTEMS
J. J. Turner *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 133-139 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10939# Saab-Scania, Linkoping (Sweden).
THE S33 PROJECT: ITS MISSION AND PAYLOAD
L. Ljunge *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 161-165 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10944# Air Force Geophysics Lab., Hanscom AFB, Mass.
SPECIAL CONSIDERATIONS TO ASSURE FLIGHT SUCCESS WITH LARGE, EXPENSIVE ROCKET PAYLOADS
C. D. Howard and R. O. Rasmussen (Space Vector Corp., Northridge, Calif.) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 199-201 ref (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10947# Centre National de la Recherche Scientifique, Toulouse (France).
***BALLOON LAUNCHING FACILITIES IN FRANCE* [LES CENTRES DE LANCEMENT DE BALLOONS EN FRANCE]**
M. Audebert and C. Bannelier *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 217-218 In FRENCH (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10967# Commissariat a l'Energie Atomique, Grenoble (France). Lab. d'Etude de la Solidification.
POTENTIAL OF MICROGRAVITY RESEARCH WITH SOUNDING ROCKETS
J. J. Favier, Y. Malmejac, and H. U. Walter (DFVLR, Cologne) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 339-344 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10968# European Space Agency, Paris (France).
***THE SIGNIFICANCE OF SOUNDING ROCKET PROGRAMS* FOR MATERIALS SCIENCE RESEARCH UNDER LOW-GRAVITY CONDITIONS**
U. Huth *In its* European Rocket and Balloon Programs and Related Res. Jun. 1980 p 345-348 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10991# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Metal Casting.
THE POSSIBILITY OF USING SOUNDING ROCKETS IN MATERIAL-SCIENCE EXPERIMENTS
H. Fredriksson *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 497-506 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10993# Technische Hochschule, Aachen (West Germany). Giesserei Inst.
***MATERIALS SCIENCE RESEARCH UNDER MICROGRAVITY* CONDITIONS IN THE GERMAN SPACE PROGRAM**
P. R. Salm and H. U. Walter (DFVLR, Cologne) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 509-520 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N81-10085*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE ENVIRONMENTAL EFFECTS ON MATERIALS
R. J. Schwinghmaer Aug. 1980 52 p refs
(NASA-TM-78306) Avail: NTIS HC A04/MF A01 CSCL 22B

The design of long life platforms and structures for space is discussed in terms of the space environmental effects on the materials used. Vacuum, ultraviolet radiation, and charged particle radiation are among the factors considered. Research oriented toward the acquisition of long term environmental effects data needed to support the design and development of large low Earth orbit and geosynchronous Earth orbit space platforms and systems is described. J.M.S.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-10086 Old Dominion Univ., Norfolk, Va.
INFLUENCE OF NONEQUILIBRIUM RADIATION AND SHAPE CHANGE ON THE FLOWFIELD OF A JUPITER PROBE WITH ABLATION AND MASS INJECTION
Sundaresa Venkata Subramanian 1980 178 p
Avail: Univ. Microfilms Order No. 8025282

The influence of nonequilibrium radiative energy transfer and the effect of probe configuration changes on the flow phenomena around a Jovian entry body was investigated. The radiating shock layer flow was assumed to be axisymmetric, viscous, laminar and in chemical equilibrium. The radiative transfer equations were derived under nonequilibrium conditions which include multilevel energy transitions. The equilibrium radiative transfer was calculated with an existing nongray radiation model which accounts for molecular band, atomic line and continuum transitions. The nonequilibrium results were obtained with and without ablation injection in the shock layer. The nonequilibrium results were found to be influenced greatly by the temperature distribution in the shock layer. In the absence of ablative products, the convective and radiative heating to the entry body were reduced significantly under nonequilibrium conditions. The influence of nonequilibrium was found to be greater at higher entry altitudes. With coupled ablation and carbon phenolic injection, 16 chemical species were used in the ablation layer for radiation absorption. Dissert. Abstr.

N81-10087# ISRO Satellite Centre, Peenya, Bangalore (India).
THE ARYABHATA PROJECT
U. R. Rao, (ed.) and K. Kasturirangan, (ed.) 1979 239 p refs Submitted for publication
Avail: NTIS HC A11/MF A01

An overview of the basic features of the Aryabhata satellite, associated ground stations and a brief account of the fabrication, testing and (in orbit) performance of the satellite is presented. Results of some of the technological experiments carried out in Aryabhata are also briefly described. R.C.T.

N81-10088*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LAUNCH SUMMARY FOR 1979
Robert W. Vostreys Aug. 1980 36 p
(NASA-TM-82273; NSSDC/WDC-A-R&S-80-08) Avail: NTIS HC A03/MF A01 CSCL 22A

Spacecraft launching for 1979 are identified and listed under the categories of (1) sounding rockets, and (2) artificial Earth satellites and space probes. The sounding rockets section includes a listing of the experiments, index of launch sites and tables of the meanings and codes used in the launch listing. S.F.

N81-10089*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NATIONAL SPACE SCIENCE DATA CENTER (NSSDC) DATA LISTING
Aug. 1980 56 p
(NASA-TM-82274; NSSDC/WDC-A-R&S-80-10) Avail: NTIS HC A04/MF A01 CSCL 22A

Satellite and nonsatellite data available from the National Space Science Data Center are listed. The Satellite Data listing includes the spacecraft name, launch date, and an alphabetical list of experiments. The Non-Satellite Data listing contains ground based data, models, computer routines, and composite spacecraft data. The data set name, data form code, quantity of data, and the time space covered are included in the data sets of both listings where appropriate. Geodetic tracking data sets are also included. J.M.S.

N81-10090*# National Aeronautics and Space Administration, Washington, D. C.
MISSION OPERATION REPORT: SBS-A/DELTA LAUNCH
Stanley I. Weiss 10 Nov. 1980 22 p
(NASA-TM-82221; O-492-213-80-01) Avail: NTIS HC A02/MF A01 CSCL 22B

The Satellite Business Systems (SBS) domestic satellite system is described. Prelaunch information concerning the Delta launch vehicle and the SBS/Hughes spacecraft is presented. The information includes mission requirements, flight mode descriptions, and predicted orbit dispersions. T.M.

N81-10091*# National Aeronautics and Space Administration, Washington, D. C.
VOYAGER BACKGROUNDER
Oct. 1980 39 p
(NASA-News-Release-80-160; P80-10172) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 22B

The design, configuration, and instrumentation of the Voyager spacecraft is presented. Mission experiments conducted by the spacecraft are described. T.M.

N81-10092# Houston Univ., Tex. Dept. of Electrical Engineering.
ANALYTICAL DESIGN OF TERMINALLY GUIDED MISSILES
Final Report, 1 Feb. - 31 Dec. 1979
Leang-San Shieh 2 Jan. 1980 139 p refs
(Contract DAAK40-79-C-0061)
(AD-A089169) Avail: NTIS HC A07/MF A01 CSCL 16/4

The newly developed dominant data matching method has been successfully extended to design a digital pitch control system of a semiactive terminal homing missile system. As a result, the designed digital controller can be implemented on a microprocessor. Also, a direct decoupling method for mulitvariable control system designs has been developed and modified. This newly developed simple and practical method can be readily applied by a practicing control engineer for coupled high order multivariable control system designs. The feasibility of synthesizing a multi port controller without using integrators has been studied. As a result, a new matrix Sturm series and block canonical form of a matrix transfer function has been developed. The practical applications of the newly developed results on multiport network

synthesis are further investigated. Other new findings of this research are reported in the appendix. GRA

N81-10093# Telefonaktiebolaget L. M. Ericsson, Moelndal (Sweden). MI Div.
ERICSSON ANTENNAS IN SPACE
Lars G. Josefsson 15 Feb. 1980 37 p
(MI-A-0021) Avail: NTIS HC A03/MF A01

Examples of satellite antennas now orbiting the Earth in operational satellites, and antennas still in development are described. Some results from studies for future advanced systems are presented. The described antenna systems include those of ISEE-B, EXOSAT, ISPM and GEOS satellites. Author (ESA)

N81-10094# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
TEST PLAN OF EUROPEAN COMMUNICATIONS SATELLITE (ECS)/MARECS NUTATION DAMPERS
F. Teule 23 Jul. 1979 13 p
(FOK-RV-79-48) Avail: NTIS HC A02/MF A01

An outline of the test methods that will be performed on the satellite nutation damper models is presented. Tests include weighing, visual and dimensional inspection, leak test, vibration test, constant acceleration, thermal vacuum, temperature cycle, and performance evaluation. The instruments used for each test are also described. Author (ESA)

N81-10095# European Space Agency, Paris (France).
FEASIBILITY STUDY OF A SPACELAB SUBSATELLITE
Juergen Puls Feb. 1980 246 p refs Transl. into ENGLISH of "Durchfuehrbarkeitsanaly fuer einen Spacelab-Subsatelliten", Rept. DLR-FB-77-67 DFVLR, Oberpfaffenhofen, West Germany, Dec. 1977 Original report in GERMAN previously announced as N80-23352
(ESA-TT-559; DLR-FB-77-67) Avail: NTIS HC A11/MF A01; DFVLR, Cologne DM 87,20

The feasibility of constructing a small inexpensive subsatellite for use in connection with the space shuttle program is discussed. The satellite is designed to carry out various scientific experiments in orbits that are independent of the main space laboratory. A modular concept characterizes the design. Special emphasis was placed on the investigation of orbital mechanics. Author (ESA)

N81-10936# Air Force Geophysics Lab., Hanscom AFB, Mass.
POST-BURNOUT THRUST MEASUREMENTS
E. F. McKenna and H. T. Smith (Space Vector Corp., Northridge, Calif.) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 141-145 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10943# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany).
THE ARIES HEAT SINK
G. Haerendel, J. J. Jerger, and J. H. Jerger *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 189-197 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10972# British Aerospace Dynamics Group, Bristol (England).
A EUROPEAN MICRO-GRAVITY ROCKET PROGRAM
D. N. Hoare, J. D. Mitchard, R. Klett (Kayser-Threde GmbH, Munich), and A. Schmalz *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 367-370 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-11002# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF ARIANE'S MAJOR COMPONENTS DISCUSSED
M. Desloire *In its* West Europe Rept.: Sci. and Technol., No. 4 (JPRS-74613) 21 Nov. 1979 p 9-35 refs Transl. into ENGLISH from L'Aeronauti. et L'Astronaut. (France), no. 77, 1979 p 35-48 (For primary document see N81-11001 01-99)
Avail: NTIS HC A06/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N81-10096# Tennessee Univ. Space Inst., Tullahoma.
CONTROL OPTIMIZATION FOR A DUAL-MODE SINGLE-STATE NUCLEAR SHUTTLE
Thomas Conley Powell and Susan Gay Dodd 1980 62 p refs
(Contract F49620-79-C-0166)
(AD-A089618; AFOSR-80-0753TR) Avail: NTIS HC A04/MF A01 CSCL 22/2

The performance of a single stage surface to orbit shuttle whether chemical propellant or nuclear can be considerably improved by 'mixed mode' propulsion. A mixed mode shuttle would be fitted with engines designed to use two different propellant combinations a highthrust (mode 1) propellant, such as ammonia, and a high specific impuse (mode 2) propellant, such as hydrogen. The first step in the evaluation of the mixed mode nuclear shuttle is a preliminary trajectory optimization study. This study, using a simple mission and a simple shuttle model, would be the basis for more complex trajectory optimization studies. The problem considered in this thesis is that of minimizing the propellant expenditure of a mixed mode nuclear shuttle for a given orbit. The starting point for any optimization problem is a mathematical model of the ssystem, in state variable form. Application of the methods of optimal control theory results in a two point boundary value problem and an associated algebraic problem. Three numerical methods are briefly described which could be used to solve these problems. The analysis of the problem is given in detail, along with numerical results for various combinations of the input variables, and the finite difference computer program, properly documented. GRA

N81-10940# British Aerospace Dynamics Group, Bristol (England).
MODEST PAYLOADS FOR SHUTTLE
D. J. Brown and L. Callard *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 167-176 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N81-10097# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.
A BIBLIOGRAPHY ON NON-GAUSSIAN SIGNAL PROCESSING, 1971 - 1980
W. W. Chen 20 Aug. 1980 13 p
(Contract N00014-79-C-0494)
(AD-A088559; SMU-EE-TR-80-8) Avail: NTIS HC A02/MF A01 CSCL 09/4

Existing algorithms for 'worst case' situations in the presence of intentional man made noise are analyzed. Techniques for weak signal extraction in the presence of strong signals are investigated. NonGaussian models appropriate for reverberation or reverberation like noise found in shallow water environments are studied. The extent of nonGaussian sources of impulsive noise interference in underwater acoustic signal processing problems of Navy interest is examined. L.F.M.

N81-10098# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.

STUDY OF A CLASS OF NON-GAUSSIAN SIGNAL PROCESSING PROBLEMS
C. H. Chen 12 Aug. 1980 17 p refs
(Contract N00014-79-C-0494)
(AD-A088558; SMU-EE-TR-80-6) Avail: NTIS HC A02/MF A01 CSCL 09/4

A broad spectrum of correlated problem areas in nonGaussian signal processing is discussed. These include: (1) nonlinear adaptive procedures to assess their detection performance against transient signals; (2) nonlinear spectral analysis techniques such as the Maximum Entropy Spectral Analysis (MESA) and the Maximum Likelihood Method (MLM) to assess their detection performance against transient signals; (3) techniques for weak signal extraction in the presence of strong interfering signals. As a special case, potential techniques for detecting broadband (such as spread spectrum) signals can be explored including the analysis of changes in noise statistics caused by pseudonoise signals; and (4) the use of nonparametric and robust statistical approaches to devise algorithms which perform well under different noise characteristics. J.M.S.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-10099 Virginia Polytechnic Inst. and State Univ., Blacksburg.
OPTIMAL LARGE ANGLE SPACECRAFT ROTATIONAL MANEUVERS Ph.D. Thesis
James Daniel Turner 1980 209 p
Avail: Univ. Microfilms Order No. 8024020

Problems associated with optimal large angle spacecraft rotational maneuvers are discussed. Both rigid and flexible body dynamical models for these vehicles are considered. Three relaxation/analytic continuation methods are developed for iteratively solving the two point boundary value problem which results in the treatment of these problems. Boundary condition relaxation processes, differential relaxation processes, and hybrid relaxation processes are detailed. In the literature these relaxation processes are closely related to a number of methods for solving nonlinear equations, imbedding, and homotopy chain methods. Dissert. Abstr.

N81-10100*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VIKING '75 SPACECRAFT DESIGN AND TEST SUMMARY. VOLUME 1: LANDER DESIGN
Neil A. Holmberg, Robert P. Faust, and H. Milton Holt Nov. 1980 213 p ref 2 Vol.
(NASA-RP-1027; L-12087-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 22B

The Viking Mars program is summarized. The design of the Viking lander spacecraft is described. T.M.

N81-10101*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VIKING '75 SPACECRAFT DESIGN AND TEST SUMMARY. VOLUME 2: ORBITER DESIGN
Neil A. Holmberg, Robert P. Faust, and H. Milton Holt Nov. 1980 318 p 2 Vol.
(NASA-RP-1027; L-12087-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 22B

The design of the Viking orbiter spacecraft is described. System configuration, telecommunications, and guidance and control requirements are presented. T.M.

N81-10102# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
NOSE TIP SHAPE OPTIMIZATION FOR MINIMUM TRANSPIRATION COOLANT REQUIREMENTS Final Report, 1 Aug. 1976 - 30 Jun. 1978
R. L. Baker and R. F. Kramer 15 Sep. 1980 42 p refs
(Contract F04701-79-C-0080)
(AD-A089185; TR-0080(5550-0)-3; SD-TR-80-64) Avail: NTIS HC A03/MF A01 CSCL 16/3

Expressions for the total heat transfer to a nose tip for a realistic reentry trajectory have been obtained by using local laminar and turbulent convective heat transfer relationships and extending the trajectory integration procedures of earlier investigators. Then, employing approximate relationships for the boundary layer edge properties along the nose tip surface, a variational calculus approach to determine nose tip shapes which minimize the total trajectory heat transfer (coolant requirements) for fixed fineness ratio and reentry parameters is utilized. The calculated minimum heat transfer shapes found have a flat nose with an expansion corner followed by an afterbody with monotonically decreasing slope. The height of the flat nose relative to the base radius decreases as the fineness ratio decreases. However, for fineness ratios greater than 0.2, the laminar and turbulent solution shapes were found to be very similar to one another. For fineness ratios approaching zero (i.e., slender bodies), the laminar and turbulent minimum heat transfer shapes are 1/2 and 8/13 power law bodies, respectively. The relative heat transfer rate to a particular one of the minimum heat transfer shapes was found to be a factor of up to three times lower than that for other body shapes having the same fineness ratio. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N81-10945# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Mobile Raketenbasis.
DEVELOPMENT AND NEW TASKS OF THE DFVLR-GSOC MOBILE RAKETENBASIS
R. Klein *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 205-210 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10946# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
EL ARENOSILLO SOUNDING ROCKET RANGE
J. Casas and M. Vilches *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 211-216 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10949# Swedish Space Corp., Kiruna.
ESRANGE ACTIVITIES: SOUNDING ROCKETS, BALLOONS AND SATELLITES
A. Helger *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 223-229 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10950# Royal Norwegian Council for Scientific and Industrial Research, Oslo. Space Activity Div.
RECENT AND FUTURE INVESTMENTS AT THE ANDOEYA ROCKET RANGE
A. Adolfsen, R. Bjurstroem, and A. Gundersen *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 231-234 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10977# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
ACTIVE PLASMA STUDIES THROUGH GROUND-BASED EXPERIMENTS IN SCANDINAVIA
J. A. Fejer *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 393-397 refs (For primary

document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10978# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
THE HERO PROJECT: ROCKET EXPERIMENTS IN THE ARTIFICIALLY HEATED IONOSPHERE
G. Rose *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 399-405 refs Sponsored by Bundesminister fuer Forschung und Technologie (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10981# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
PLANS FOR A NEW MAGNETOMETER NETWORK IN NORTHERN SCANDINAVIA
B. Theile and S. Thuerey *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 417-420 refs Prepared in cooperation with Finnish Meteorological Inst. and Muenster Univ. (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N81-10103# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
STABILITY PREDICTION FOR SOLID PROPELLANT ROCKET MOTORS WITH HIGH SPEED MEAN FLOW Final Report
Gary A. Flandro Aug. 1980 55 p refs
(AF Proj. 5730)
(AD-A089306; AFRPL-TR-79-98) Avail: NTIS HC A03/MF A01 CSCL 21/8

Current stability prediction calculations for solid propellant rocket motors are based upon a simple first-order perturbation solution which assumes an incompressible chamber mean flow. Since combustion instability is frequently observed in motors with large length-to-diameter and low port-to-throat area ratios, there is concern that the standard stability techniques should be extended to apply to cases where high-speed mean flows are present. This report shows how the basic stability analysis can be extended by carrying additional terms in the perturbation expansions. Compressibility affects the calculations in several ways. The acoustic mode shapes predicted in the linear model are distorted and the mean thermodynamic properties may vary significantly from point to point in the chamber. These variations and distortions alter both the predicted growth rates and also the frequencies for the acoustic modes. Detailed calculations are carried out for a cylindrical grain geometry with longitudinal wave motions. Frequency and growth rate corrections grow quadratically with increases in the port length-to-diameter ratio. Frequency shifts of as much as 30 percent of the linear acoustic frequency predictions may be expected in high L/D motors.
GRA

N81-10104# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Analysis Section.
LGM30B, STAGE 2 DISSECTED MOTORS TEST REPORT Semiannual Report
Daryl Anderson Jul. 1980 156 p refs
(AD-A089158; MAKPH-443(80)) Avail: NTIS HC A08/MF A01 CSCL 21/8

This report contains the data obtained from testing propellant and case bond materials from two dissected Minuteman Stage II motors. The tests conducted were in accordance with Service Engineering (MMWRME) General Test Directive GTD-1 Dissect dated 28 June 1974. The directive specifies the tests required to elucidate any age induced problems which may affect the service life of the Stage II motor. Linear regression analysis was used to indicate trends of the test parameters. A representative regression plot was made of several parameters with each motor tested to date identified by different symbols. The regression analysis normally verified the trends established during the last test phase. Although there were a few trends which changed from significant to nonsignificant and a few that changed from nonsignificant to significant it does not seem likely that any problems of major concern are apparent at this time. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N81-10105 State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
AN OPTICAL METHODOLOGY FOR RELATING FRACTURE BEHAVIOR OF PARTICLEBOARD TO ITS STRUCTURE Ph.D. Thesis
James Page Armstrong 1979 219 p
Avail: Univ. Microfilms Order No. 8019074

An optical methodology for study of internal bond type fracture of particle board manufactured with urea formaldehyde adhesive was developed. The methodology included techniques for locating resin sites on the fracture surface, for study of surface detail, and for evaluation ot microtopography. Fracture morphology was found to reflect the influence of certain processing variables, environmental influences, and load history. The location of urea formaldehyde resin on the fracture surfaces was identified with the aid of staining the samples with a fluorescent dye. Following staining, resin distribution and bond characteristics were determined by examination utilizing fluorescence microscopy and cathodoluminescence microscopy in the scanning electron microscope. Stereo imaging and a computer controlled multiple electron backscatter detector method were utilized for microtopographical evaluation. The influence of moisture content temperature, and load history was reflected by the incidence and character of wood failure, and by surface microtopography. Dissert. Abstr.

N81-10106 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THREE-DIMENSIONAL INELASTIC FINITE ELEMENT ANALYSIS OF LAMINATED COMPOSITES Ph.D. Thesis
Odis Hayden Griffin, Jr. 1980 175 p
Avail: Univ. Microfilms Order No. 8024006

Three dimensional inelastic response of laminated composites to thermal and mechanical loading is formulated and analyzed using the finite element method. Individual laminae are modeled as homogeneous and transversely isotropic, with material nonlinearities introdured via a Hill-type yield criterion and an incremental plasticity approach. Nonlinear isotropic hardening is described by Ramberg-Osgood representations of uniaxial stress-strain data. A nonlinear hardening coefficient is derived based on extrapolation of plastic straining during the incremental loading process. Constitutive equations for thermal effects include either constant or temperature dependent expansion coefficients. The formulations are used as the basis for development of a computer program designated NALCOM (Nonlinear Analysis of Laminated COMposites). Elastic and elastic-plastic response of boron/epoxy and graphite/epoxy and problems of curing are analyzed. Mechanical loading of laminates is modeled, and symmetry conditions which exist in angle ply laminates are discussed. Dissert. Abstr.

N81-10107 Tennessee Univ., Knoxville.
FAILURE AND FRACTURE ANALYSIS OF BRITTLE DUCTILE COMPOSITES USING COMPUTER SIMULATION METHOD Ph.D. Thesis
Kamalaksha Sarkar 1980 267 p
Avail: Univ. Microfilms Order No. 8024928

A computer simulation method was developed to study the failure and fracture behavior of both brittle and ductile composite materials. Unidirectional and cross-ply glass fiber reinforced epoxy composites with approximately 50% reinforcement were investigated to predict their unnotched strengths. Relations were also developed to predict the notched strengths and the critical stress intensity factors for off axis composites. A gradually graded finite element method was developed to study the failure of ductile composites. It was shown that the simple method took a reasonable amount of computer time to solve elastoplastic problems using conventional elements. Dissert. Abstr.

N81-10108 Washington Univ., St. Louis, Mo.
EFFECTS OF STRESS AND TEMPERATURE ON THE ELECTRICAL RESISTANCE OF CARBON-FIBERS Ph.D. Thesis
Kunio Komaki 1980 188 p
Avail: Univ. Microfilms Order No. 8026259

The electrical resistance of individual carbon fibers was measured as a function of temperature (liquid nitrogen, LN = 196, and 0 to + 50 C) and tensile strain by a potentiometric method. A wide variety of fiber types made from different precursors (pitch, rayon, polyacrylonitrile (PAN), and pitch mesophase) with a range of laboratory heat treatment temperatures (HTT, from < 1000 to 3000 C, 30 minute duration) were investigated to survey a broad range of microstructures. The decrease of fiber resistivity with increasing HTT is qualitatively similar to that of comparable bulk carbon materials. The temperature dependence of resistance is negative and the magnitude of both the ratio R sub LN/R sub O and the O to + 50 C temperature coefficient of resistance, TCR = dlnR/dT pass through a minimum then increase toward a maximum with increasing HTT. A maximum TCR = -1700 ppm/deg C is achieved by pitch mesophase and approached by PAN and hot stretched rayon at the highest HTT. The piezoresistance behavior is elastically reversible at low strains and it is positive (resistance increases with strain) and approximately linear for most fibers. Additional results are detailed. Dissert. Abstr.

N81-10109 Washington State Univ., Pullman.
BEHAVIOR OF FIBERGLASS REINFORCED PARTICLEBOARD BEAMS AND PLATES IN FLEXURE Ph.D. Thesis
William Martin Bulleit 1980 135 p
Avail: Univ. Microfilms Order No. 8025909

Particleboard made from ring cut flakes was reinforced using phenolresorcinol formaldehyde resin impregnated fiberglass. The surface reinforced flakeboard was tested in beam and plate flexure. Elastic analyses were performed for both the beams and plates. Plates with surface reinforcement oriented in one major direction of the plate were tested and analyzed using plate sizes of 16 by 16 inches and 18 by 16 inches. Deflection at the center of the plate under a concentrated load and a uniform load was predicted. Reinforced and unreinforced beams were tested under third point loading. The length to thickness ratio was about 35. The deflection at the center of the span was predicted with about 4 percent error. The reinforced beams were about 8 percent fiberglass by volume. The reinforced beam stiffness was about 3.4 times that of the unreinforced beams; and the ultimate moment capacity was increased by a factor of about 2.8. Dissert. Abstr.

N81-10110 Pennsylvania State Univ., University Park.
PIEZOELECTRIC COMPOSITES WITH 3-1 CONNECTIVITY FOR TRANSDUCER APPLICATIONS Ph.D. Thesis
Kenneth Alan Klicker 1980 191 p
Avail: Univ. Microfilms Order No. 8024461

Lead zirconate titanate (PZT), a dense ceramic with high piezoelectric coefficients and a high relative permittivity, has a low hydrostatic piezoelectric coefficient, and low piezoelectric voltage coefficients. Through the concept of connectivity, it is possible to design composites of PZT and a polymer which overcome some of the disadvantages of PZT ceramic. Composites with 3-1 connectivity were fabricated in which extruded PZT rods have been embedded in a matrix of a hard epoxy. Composites with 3-1-0 connectivity were also fabricated. These composites have a matrix of polyurethane which is approximately forty volume percent porous. These composites have coefficients which are, respectively, four, fifty; and two hundred times greater than those of solid PZT. The density of these composites (> 0.94 gm/cc) is low enough that they have positive buoyance in water. Dissert. Abstr.

N81-10111 Pennsylvania State Univ., University Park.
ELEVATED-TEMPERATURE INSTRUMENTED CHARPY IMPACT TESTING OF COMMERCIAL AND EXPERIMENTAL SILICON CARBIDES Ph.D. Thesis
Harish Chandra Chandan 1980 262 p
Avail: Univ. Microfilms Order No. 8024434

The impact resistance of several SiC's was measured to 1700 C using a modified pendulum type machine and Charpy-like specimens. The SIC's included seven commercially available bodies, and nine experimental SiC's which were hot pressed to obtain microstructures with a morphology of large grains or fibrous grains in a fine grain size matrix. All these SiC's exhibited purely elastic behavior at temperatures less than 1600 C. At T greater than or equal to 1600 C, a propagation energy type of semicontrolled fracture was observed for two of the commercial bodies. The impact resistance and the fracture stress decreased with temperature for each of the SiC's. No significant improvements in fracture stress or impact resistance were observed for the microstructural modifications employed. The trends in the fracture mode with impact resistance, grain size and temperature are not well defined, although elevated temperatures appear to bias the fracture towards the intergranular mode. Dissert. Abstr.

N81-10112*# TRW, Inc., Cleveland, Ohio. Materials Technology Lab.
TUNGSTEN WIRE-REINFORCED SUPERALLOYS FOR 1093 C (2000 F) TURBINE BLADE APPLICATIONS Final Report
G. I. Friedman and J. N. Fleck Oct. 1979 72 p refs
(Contract NAS3-20084)
(NASA-CR-159720; TRW-ER-8135) Avail: NTIS HC A04/MF A01 CSCL 11D

Various combinations of fiber and matrix materials were fabricated and evaluated for the purpose of selecting a specific combination that exhibited the best overall properties for a turbine blade application. A total of seven matrix alloys, including Hastelloy X, Nimonic 80A, Inconel 600, Inconel 625, IN-102, FeCrA1Y, were investigated reinforced with either 218CS tungsten, or W-Hf-C fibers. Based on preliminary screening studies, FeCrA1Y, Inconel 600 and Inconel 625 matrix composites systems were selected for extended thermal cycle tests and for property evaluations which included stress rupture, impact, and oxidation resistance. Of those investigated, the FeCrA1Y matrix composite system exhibited the best overall properties required for a turbine blade application. The W-Hf-C/FeCrA1Y system was selected for further property evaluation. Tensile strength values of up to 724 MPa (105,000 psi) were obtained for this material at 982 C and 607 MPa at 1093 C. Author

N81-10113# Naval Ship Research and Development Center, Bethesda, Md.
MODELING OF INELASTIC BEHAVIOR OF STRUCTURES USING PLASTIC AND METAL LAMINATES Final Report
R. A. Swanek, James L. Rodd, Harry M. Ford, and Alfred L. Disenbacher Aug. 1980 54 p refs
(ZR02301)
(AD-A089132; DTNSRDC-80/073) Avail: NTIS HC A04/MF A01 CSCL 11/9

A review of past research concerning the determination of structural ultimate strength and/or inelastic behavior in isotropic metallic structures revealed that (1) most investigations of this type are carried out on full-size or nearly full-size models requiring large test loads and facilities, (2) small-scale modeling of this structural behavior using the parent metal requires a high degree of skill in the fabrication of the model and a subsequent high cost, and (3) no useful and cost effective method of extending small-scale structural modeling into the inelastic range currently exists. The basic criteria to be satisfied when modeling an isotropic metallic structure elastoplastically using another material are:

duplication of stress/modulus versus strain behavior for both model and prototype materials and equality of Poisson's ratio for model and prototype material. Additionally, a structural model using another material must possess the same bending, axial, torsional, and buckling properties as the prototype structure using the parent material. A composite material made up of stainless steel and rigid vinyl was developed to model a mild steel parent material. This composite material was then shown to satisfy the basic criteria needed to elastoplastically model a structure through tests which defined the elastic and inelastic material properties in tension and bending. A deep plate girder structure, for which ultimate strength data exists, was modeled using the composite material and tested. Both the failure mode and ultimate strength of the mild steel girder were accurately reproduced using the composite material. GRA

N81-10114# Washington Univ., Seattle. Dept. of Mining, Metallurgical and Ceramic Engineering.
STRESS-INDUCED EFFECTS UPON THE STRUCTURE AND PROPERTIES OF CARBON FIBERS Final Technical Report, 1 Mar. 1976 - 31 May 1980
David B. Fischbach, Kunio Komaki, and Seshadri Srinivasagopalan 31 Jul. 1980 16 p refs
(Grants DAAG29-76-G-0169; DAAG29-78-G-0142)
(AD-A089207; ARO-13485.6-MS) Avail: NTIS HC A02/MF A01 CSCL 11/5

Microstructures and structural development with heat treatment of carbon fibers from pitch, rayon, polyacrylonitrile and pitch mesophase were characterized by diamagnetic susceptibility and SEM; and the dynamic torsional behavior (modulus, damping at about 1 Hz) and electrical resistance properties (resistivity, temperature dependence, piezoresistance) of individual fibers were measured and compared. A survey of the structure-dependence of the fiber properties revealed similarities that appear to be common to all stratic (hexagonal layer) carbon materials, as well as characteristic differences associated with fiber precursor type and processing. GRA

N81-10115# TriTec, Inc., Columbia, Md.
FINEBLANKING, DIFFUSION BONDING, AND TESTING OF FLUIDIC LAMINATES Final Report, May 1979 - Jul. 1980
Lester K. Pecan Jul. 1980 97 p refs
(Contract DAAK21-79-C-0074)
(AD-A089347; HDL-CR-80-074-2) Avail: NTIS HC A05/MF A01 CSCL 13/7

Two manufacturing processes that show promise of improving the performance of laminated aluminum fluidic components are fineblanking and semi-solid-state diffusion bonding. A representative three-stage amplifier design was used as the basis for evaluating these processes. Amplifier and manifold laminates were produced by fineblanking, and amplifier modules were fabricated by diffusion bonding of the fineblanked laminates. Functional (pressure gain) tests conducted before and after bonding showed gain changes in all bonded modules, but the number of modules bonded was too small to permit determination of any pattern. Surface and dimensional quality of the fineblanked laminates was excellent in laminate thicknesses up to 0.51 mm for amplifier elements, and up to 3.18 mm thickness for manifold laminates. Overall quality was judged to be equivalent to that normally achieved by the photochemical etching process. Due primarily to high initial die cost, fineblanking is economically feasible only where large production quantities are required; diffusion bonding, at the present state-of-the-art, relies heavily on human operator technique and appears to need further development before it can be considered a viable production process. GRA

N81-10116*# Army Dugway Proving Ground, Utah.
LARGE-SCALE OUTDOOR FIRE-RELEASED CARBON FIBER TESTS Final Report, Jul. 1979 - Jan. 1980
John H. Whiting, Gary L. Sutton, William A. Peterson, and Neil G. Magann Jul. 1980 341 p refs Sponsored by NASA. Langley Research Center
(AD-A089012; NASA-CR-163686; DPG-FR-80-30) Avail: NTIS HC A15/MF A01 CSCL 11/5

Five large-scale outdoor pool fire tests three source/dissemination and two source resulted in obtaining characteristic data of carbon fibers released into the atmosphere when carbon fiber/epoxy matrix composite structural components were exposed to large-scale outdoor jet-fuel fires representative of fires expected to be experienced in civil aircraft accidents. Estimated source strength release of carbon fibers varied from 1.1 x ten to the 8th power to 2.9 x ten to the 8th power single fibers released under burn conditions of moderate to high wind speeds required in the source/dissemination tests. Estimated source strength data for these trials was derived from fibers captured on a vertical mesh sampler array designed to intercept the fire plume downwind of the source. Estimated single fiber source strengths, derived from the two source burn tests wich required wind speeds to be near zero, varied from 2.2 x ten to the 8th pwer to 2.9 x ten to the 8th power. The fiber data for these tests was obtained by a passive sampler designed to capture fibers contained in the fire plume and rising from the fire. Good correlation of source strength estimates was obtained by the two fiber sampling methods. The mean length of fibers collected on the stainless steel mesh amplers on the vertical array was 4.8 mm while the mean length of fibers collected on the overhead @Peterson@and DPG stainless steel mesh samplers attached to the overhead conopy array was 3.0 mm. GRA

N81-11003# Joint Publications Research Service, Arlington, Va.
IMPROVED THERMAL INSULATION IN POWER PLANTS DISCUSSED
W. E. Fuchs *In its* West Europe Rept.: Sci. and Technol., No. 4 (JPRS-74613) 21 Nov. 1979 p 39-47 refs Transl. into ENGLISH from Brennstoff-Waerme-Kraft (Dusseldorf), no. 9, Sept. 1979 p 353-355 (For primary document see N81-11001 01-99)
Avail: NTIS HC A06/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N81-10117 Houston Univ., Tex.
CROSSED BEAM LC/MS USING LASER VAPORIZATION FOR SAMPLES OF ENVIRONMENTAL INTEREST Ph.D. Thesis
Mary Jane Phinney 1979 152 p
Avail: Univ. Microfilms Order No. 8025017

A new approach to combined liquid chromatography/mass spectrometry (LC/MS) is described which uses laser vaporization of the liquid chromatograph (LC) effluent and molecular beam techniques to transport and ionize the sample. Samples eluting from the LC are vaporized, ionized, and mass analyzed with minimal contact with solid surfaces. The utility of an instrument based on this approach was evaluated. The present status of LC/MS interfaces is discussed and the need for a practical LC/MS interface system is established. The instrumentation involved in this work is described. Theoretical discussions of laser vaporization and of the mechanism for transporting the solute into the ionization region of the mass spectrometer are presented. Mass spectra are presented which were obtained from laser vaporization of the LC effluent under both reversed phase and ion exchange conditions. Dissert. Abstr.

N81-10118 University of South Florida, Tampa.
A STUDY OF FACTOR ANALYSIS WITH APPLICATIONS IN X-RAY PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
Richard A. Gilbert 1980 166 p
Avail: Univ. Microfilms Order No. 8022929

The use of principal component analysis for X-ray photoelectron spectroscopy is described. Two series of experiments were carried out: (1) measurements on a gold sample with the intention of examining the utility of factor analysis for instrument performance; (2) measurements on the X-ray induced decomposi-

tion of potassium perchlorate samples to evaluate the utility of factor analysis for spectral deconvolution without making assumptions concerning the exact form of the spectra. The gold spectra, with a single dominant contribution present in all data vectors showed substantial recovery of the trace for a single eigenvector when the covariance about the origin matrix, Co, was analyzed. Malinowski's theory of error was used to evaluate the results derived from the multiple scans of the perchlorate data. Two significant components in the perchlorate system were found. Rotation of the Co derived eigenvectors into fundamental underlying spectra revealed components corresponding to the spectra associated with chloride, chlorate and perchlorate ions.
Dissert. Abstr.

N81-10119 Engineering Sciences Data Unit, London (England).
SURFACE TENSION OF WATER
1980 2 p
(ESDU-80005; ISBN-0-85679-289-6) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161.

An equation for the surface tension of water that is in agreement with the current International Formulation is presented. Typical applications are in heat transfer and fluid flow calculations in the design of chemical plant and steam turbines, boilers, and other mechanical engineering equipment. The range of applicability are the temperatures from triple point to critical point along saturation line.
ESDU (GRA)

N81-10120 Wisconsin Univ. - Madison.
A SOLUTION MODEL FOR GAS CHROMATOGRAPHIC STUDIES Ph.D. Thesis
Jan-Chan Huang 1980 299 p
Avail: Univ. Microfilms Order No. 8018118

An improved solution model, based on a partition function which combines the chain liquid theory of Flory and the quasi-chemical relation between functional groups, is developed. An equation of state and expressions for excess volume, excess enthalpy, and excess free energy of mixing are derived. The mathematical structure of solution theory and some representative solution models are reviewed. Prediction of the excess enthalpy and excess entropy of mixing provides a more sensitive test of solution theories than prediction of the excess free energy. Three parameters, the external degree of freedom, the core volume, and the cell energy of some organic compounds as calculated are found to follow simple linear summation rules. The molar volumes of simple, polar, and polymeric compounds are successfully correlated over a wide range of temperatures and pressures. The excess free energy expression is applied to gas chromatographic data. With computed size correction entropy and the equation of state behavior, the measured excess free energy data gave meaningful contact energy differences for alkane and aromatic solutes.
Dissert. Abstr.

N81-10121 Pennsylvania State Univ., University Park.
CHEMICAL VAPOR DEPOSITION OF Nb3Ge Ph.D. Thesis
Chang-Feng Wan 1980 255 p
Avail: Univ. Microfilms Order No. 8024504

The chemical vapor deposition (CVD) of NB3Ge was examined. The CVD process was studied with respect to the phase equilibria, thermodynamic properties phase diagram calculations, crystal chemistry of the Nb-Ge system, and chlorination of niobium metal. The Nb-Ge was chemical vapor deposited from NbCl5, GeC14, and H2 gases on tubular graphite substrates. The deposition rates, deposit compositions, and phases deposited were studied as a function of deposition temperature, total pressure, Nb/(Nb + Ge) and H/(H + Cl) mole fractions in the reactant gas, and flow rates.
Dissert. Abstr.

N81-10122 Rochester Univ., N. Y.
CATALYTIC DECOMPOSITION OF N2O ON NiO(100), Ni AND Pt SURFACES USING MODULATED MOLECULAR BEAM SCATTERING Ph.D. Thesis
Ahmet N. Arslancan 1980 372 p
Avail: Univ. Microfilms Order No. 8023910

An existing modulated molecular beam apparatus was modified to provide a high intensity supersonic nozzle beam source and a completely bakeable ultrahigh vacuum test chamber. The catalytic decomposition of nitrous oxide on NiO(100) and polycrystalline Ni was investigated utilizing reactive scattering of a modulated N2O nozzle beam. A polycrystalline Pt catalyst surface was also examined. The angular distributions of the scattered gas beams (products and unreacted N2O) from target followed by both Lock-in detection and digital waveform analysis. Target surface characterization was performed with LEED/AES electron optics, and the surface cleaning was done by in situ argon ion sputtering and high temperature annealing in cycles of O2 and H2. The dependence of the catalytic reaction on the nature of the background gas and the target surface temperature 298-1250 K was investigated.
Dissert. Abstr.

N81-10123 Wesleyan Univ., Middletown, Conn.
OPTICAL SPECTROSCOPY OF LINEAR POLYENES Ph.D. Thesis
Judith Kathryn Bannon Snow 1980 193 p
Avail: Univ. Microfilms Order No. 8024028

The investigations of the electronic and molecular structure of several linear polyenes are presented. For polyenes with four or more double bonds, it is known that the lowest excited singlet has A sub g symmetry. Attempts to locate this one photon optically forbidden state in hexatriene by detecting fluorescence are described. Although fluorescence is observed at 4.2K, no emission can be attributed unambiguously to hexatriene. Low temperature high resolution spectra are presented for octatetraene in a series of alkane crystals. The prominent vibrational modes are essentially the same in all of the alkane matrices. Qualitative analysis of the electronic origin region indicates that the transition between the ground state and the 21A sub 8 is symmetry forbidden in octane and symmetry allowed in hexane. The transition exhibits both characteristics in heptane, nonane and decane. The transition exhibits both characteristics in heptane, nonane and decane. These analyses provide information about the molecular geometry of octatetraene in the crystal lattice at 4.2K.
Dissert. Abstr.

N81-10124 City Univ. of New York, N. Y.
HOMOGENEOUS LIQUID-LIQUID EXTRACTION Ph.D. Thesis
Chia-Swee Hong 1980 114 p
Avail: Univ. Microfilms Order No. 8023709

Problems in solvent extraction, e.g., slow extraction rates and incomplete extractions are examined. A homogeneous liquid-liquid extraction method using propylene carbonate is developed, which is characterized by immediate formation of the complex upon achieving a single homogeneous liquid phase at elevated temperature. Two distinct phases appear upon cooling to room temperature. The extraction behavior of both monodentate and bidentate complexes is investigated and compared with the usual liquid-liquid extractions. Butylene carbonate, an analogue of propylene carbonate, is also studied as an extractant. Atomic absorption is applied to the analyses of both organic and aqueous phases by direct comparison with the standards. Potentialities of homogeneous liquid-liquid extraction are demonstrared such as application to problems in separation chemistry for which the conventional solvent extraction procedure is inadequate.
Dissert. Abstr.

N81-10125 Oklahoma State Univ., Stillwater.
EQUILIBRIUM CONSTANTS FOR PHYSICAL SOLVENTS IN NATURAL GAS Ph.D. Thesis
Adeyinka Akibu Adeyiga 1980 103 p
Avail: Univ. Microfilms Order No. 8027156

A simple procedure for investigating the vaporization equilibrium ratios of carbon dioxide and hydrogen sulfide in physical solvents was developed. The procedure uses a single equilibrium cell and samples only the vapor phase for the determination of K values for the components and conditions of interest. The K values for carbon dioxide and hydrogen sulfide were determined in tetra ethylene-glycol-dimethyl-ether, tetra-methylene-sulfone and propylene carbonate at pressures up to 100 psia and temperatures from 50 to 150 F. The technique developed and the apparatus designed were found to be sound as illustrated by the consistency, reproducibility, and reliability of the data. Of the three physical solvents studied, tetra-ethylene-glycol-dimethyl-ether was found to be the most effective for both hydrogen sulfide and carbon dioxide removal from sour gas streams.
Dissert. Abstr.

N81-10126 Pennsylvania State Univ., University Park.
HIGH RESOLUTION RAMAN AND INFRARED SPECTROSCOPY OF GASES Ph.D. Thesis
Barry Rubin 1980 108 p
Avail: Univ. Microfilms Order No. 8024489

A high resolution Raman spectroscopic system is described. It consists of an argon ion laser, a 2.25 m Czeny Turner spectrometer with a double passed 8 inch diffraction grating, and a digital photon counter with computer interface. A discussion of the photometry of the collection optics is given. The Raman active fundamentals and the first overtone of the inactive fundamental of SF6 gas were recorded with sufficient resolution to observe some of the hot band Q branches. Improved values for the band origins of the main Q branches were obtained and several anharmonicity constants were calculated. The rotational Raman spectrum of cyclopropane was measured to J = 43. A method of analysis was developed which takes into account the unresolved K structure of the lines. The method assigns an effective value of K to the center of each observed line and allows a simultaneous fit of the R and S branches to the ground state rotational constants B, D sub J, and D sub JK. Dissert. Abstr.

N81-10127 Ohio Univ., Athens.
DEVELOPMENT OF METHODS FOR THE REMOTE SENSING OF GASES Ph.D. Thesis
David Lee Grieble 1980 157 p
Avail: Univ. Microfilms Order No. 8025558

The feasibility of a general technique for the qualitative and quantitative analysis of hot gases from combustion processes by remote sensing was studied. The technique was based on the measurement of infrared emission spectra of hot CO2 at moderate resolution. A nonlinear least-squares best fit of emission maxima was made after convolving the theoretical line profiles of the rotational lines in the hot bands of CO2 at 9.4 and 10.4 microns with the instrument line shape function of the Fourier transform infrared spectrometer being used to measure the spectrum. From parameters obtained from the fitting programs, the temperature and concentration of CO2 present in the hot gas was determined. In order to obtain good results from these programs, accurate line width data were needed. The temperature and pressure dependence of line widths for self broadened and nitrogen broadened lines in the vibration rotation spectrum of CO2 were needed. Dissert. Abstr.

N81-10128# National Bureau of Standards, Washington, D.C. Center for Fire Research.
IGNITION OF A LIQUID FUEL Final Progress Report, 1 May 1978 - 30 Sep. 1979
Takashi Kashiwagi, Howard R. Baum, and John A. Rockett Jan. 1980 78 p refs
(Grant AF-AFOSR-0006-79; AF Proj. 2308)
(AD-A089295; AFOSR-80-0476TR) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report summarizes progress in the study of ignition of a liquid fuel under high intensity radiation. It describes an experimental study of the key processes during ignition and a theoretical modeling study of part of the phenomena during the ignition period. The experiments were conducted using a CW CO2 laser with incident fluxes from 1000 to 5000 W/sq cm and n-decane as the flammable liquid. High speed photographs of ignition events showed a periodic depression in the decane surface, probably caused by the thrust of the strong decane vapor flux; radial outward motion of the liquid, probably caused by a surface tension, gradient was also observed. The first appearance flame was in the gas phase well above the surface. The proposed autoignition mechanism of decane by the CO2 laser is the absorption of the incident laser beam by the vapor plume. The effect on ignition of the incident angle of the laser beam with respect to the decane surface was studied from 90 to 30 degrees. On reducing the incident angle, the ignition delay time becomes longer and the minimum incident flux for ignition increases significantly. A theoretical model describing the flow motion in the gas phase caused by a heated surface was calculated numerically and solved analytically. GRA

N81-10129# Michigan State Univ., East Lansing. Dept. of Chemistry.
SOLVENT ISOTOPE EFFECTS UPON THE KINETICS OF SOME SIMPLE ELECTRODE REACTIONS
Michael J. Weaver, Paul D. Tyma, and Scott M. Nettles 15 Aug. 1980 40 p refs
(Contract N00014-79-C-0670)
(AD-A089387; TR-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

The effect of replacing H2O with D2O solvent upon the electrochemical kinetics of simple transition metal redox couples containing aquo, amine, or ethylenediamine ligands have been investigated at mercury electrodes as a means of exploring the possible contribution of ligand aqueous solvent interactions to the activation barrier to outer sphere electron transfer. Comparison of isotope rate ratios for corresponding electrochemical and homogeneous outer sphere reactions involving cationic ammine and aquo complexes yields values of isotopic rate ratios of hydrogen and deuterium for the former processes that are typically markedly larger than those predicted by the Marcus model from the homogeneous rate ratios. These discrepancies appear to arise from differences in the solvent environments in the transition states for electrochemical and homogeneous reactions. GRA

N81-10130# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
IMAGE FIELD THEORY OF ENHANCED RAMAN SCATTERING BY MOLECULES ABSORBED ON METAL SURFACES DETAILED COMPARISON WITH EXPERIMENTAL RESULTS
George C. Schatz and Richard P. VanDuyne 15 Sep. 1980 32 p refs Submitted for publication
(Contract N00014-79-C-0794)
(AD-A089156; TR-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

An image field theory of surface enhanced Raman spectroscopy is used to study the dependence of Raman intensities on light frequency, nature of adsorbate and metal, electrode potential, scattering angle and light polarization. Although the image field enhancement (IFE) theory is at best a crude approximation to the true enhancement mechanism, it does find quite reasonable agreement between the IFE predictions and most existing experimental results. GRA

N81-10131# Florida Univ., Gainesville. Dept. of Chemistry.
TEMPORAL AND SPATIAL TEMPERATURE MEASUREMENTS OF COMBUSTION FLAMES Final Report, 1 Jun. 1979 - 29 Feb. 1980
James D. Winefordner Wright-Patterson AFB, Ohio AFAPL 21 May 1980 165 p refs
(Contracts F33615-78-C-2038; F44620-78-C-0005)
(AD-A089375; AFWAL-TR-80-2045) Avail: NTIS HC A08/MF A01 CSCL 21/2

Five methods have been developed theoretically from steady state rate theory and four have been verified experimentally for the measurement of spatial flame temperatures. All of the methods have potential use on a single pulse time period less than 1 micron basis for the measurements of flame temperatures. All of the methods involve the use of one or two closely spaced in time dye laser pulses to excited atomic fluorescence of probe atoms E.G., T 1, In, Ga, etc. Introduced as an aerosol into the flames. Several experimental difficulties have resulted in initial barriers to the measurement of flame temperatures in hydrocarbon flames as well as the use of an available SIT detector for height profiles of flame temperatures. Other studies have included the theoretical development nad experimental implementation of absolute concentration measurements of atom probes in flame as well as study of saturation braodening atomic lines. GRA

N81-10132# Laser Analytics, Inc., Bedford, Mass.
HIGH RESOLUTION TUNABLE DIODE LASER MEASUREMENTS OF WATER VAPOR CONTINUUM ABSORPTION AND THEORETICAL FEASIBILITY STUDY OF WATER VAPOR LINESHAPE BY DOUBLE RESONANCE SPECTROSCOPY Final Report, Mar. 1978 - 30 Sep. 1979
R. S. Eng, A. W. Mantz, and C. G. Venkatesh 15 Oct. 1979 50 p refs
(Contract F19628-77-C-0015; AF Proj. 2310)
(AD-A089071; AFGL-TR-79-0239) Avail: NTIS HC A03/MF A01 CSCL 07/4

Water vapor continuum absorption was measured in the 900-1050/cm region using tunable diode laser and a 1 M base

White cell at 296 K and 337 K. Both continuous and spot frequency absorption show pressure squared dependence. The high resolution technique takes into account local line absorption very well in determining the continuum absorption. Results show a slightly weaker temperature dependence for the continuum absorption. A proposed double resonance spectroscopic technique is described in which a CO laser in coincidence with a water vapor line is used to pump the water vapor transition and a CW Tunable Diode Laser is used to probe the water vapor absorption coefficient up to 100 halfwidths from the pressure broadened line to determine the lineshape. GRA

N81-10133# *Wisconsin Univ. - Madison. Mathematics Research Center.*

PROPAGATING WAVES AND TARGET PATTERNS IN CHEMICAL SYSTEMS

Paul C. Fife and John Tyson May 1980 24 p refs (Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grant NSF MCS-79-04443)

(AD-A089590; MRC-TSR-2074) Avail: NTIS HC A02/MF A01 CSCL 07/4

A class of models for target patterns (concentric circular waves emanating from a point called the leading center) is constructed in the context of singularly perturbed reaction-diffusion systems of partial differential equations. First, the theory of wave fronts is detailed for scalar equations and systems of equations. A scaling method reduces complex waves to the consideration of a group of simple wave phenomena. It is shown that expanding wave fronts can be generated spontaneously at a point. This process, together with the laws of their subsequent motion, reduces the problem to an ordinary differential initial value problem, whose solution is required to have certain properties. A discussion is given of the connection between these results and experimental observations. GRA

N81-10134# *Los Alamos Scientific Lab., N. Mex.*

STUDY OF CARBON MONOXIDE PRODUCTION FROM A MULTI-HUNDRED WATT FUEL SPHERE ASSEMBLY

D. E. Peterson and D. Pavone Jun. 1980 21 p refs (Contract W-7405-eng-36)

(LA-8414-MS) Avail: NTIS HC A02/MF A01

The rate of CO production from a multi-hundred watt fuel sphere assembly was measured as a function of time and temperature in vacuum and helium atmospheres. The generation of CO was shown to be retarded by the presence of helium gas and by continued fuel reductions. Measurements of the exchange rate of isotopically enriched CO with the fuel oxygen indicated that the vents do not restrict the CO production. A small quantity of unidentified second phase was observed in the plutonia microstructure. A cyclic CO/CO2 mechanism is proposed as the source of the CO produced. DOE

N81-10135# *Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).*

STUDY OF THE REACTIONS OF THE HYDROPEROXYL RADICAL WITH AN ESR, LMR SPECTROMETER Thesis [UNTERSUCHUNG VON REAKTIONEN DES HYDROPEROXYLRADIKALS MIT HILFE EINES KOMBINIERTEN ESR-LMR-SPEKTROMETERS]

Friedrich Temps Aug. 1979 83 p refs In GERMAN

(MPIS-16/1979) Avail: NTIS HC A05/MF A01

Reaction rates of O + HO2 yields OH + O2, NO + HO2 yields OH + NO2 were determined in an isothermic flow with an electron spin resonance and a laser magnetic resonance spectrometer. The simultaneous determination of the atom and radical concentration time profile was possible. The HO2 radicals for the first were produced from F + H2O2 yields HO2 + HF. The value of the velocity constant K sub 1 (298 K) is 2.0 + or - 0.6 X 10 to the 13th power cu cm moles. The radicals HO2 for NO + HO2 yields OH + NO2 were produced from the reactions F + H2O2 yields HO2 + HF, and H + O2 + M yields HO2 + M. The resulting value of the reaction rate is k sub 2 (298 K) = (4.4 + or - 1.0 X 10 to the 12th power cu cm/moles. This value seems to be independent of the pressure between 3 mbar and 17 mbar. Author (ESA)

N81-10136# National Bureau of Standards, Washington, D.C. National Measurement Lab.

STANDARD REFERENCE MATERIALS: METAL-ON-QUARTZ FILTER AS A STANDARD REFERENCE MATERIAL FOR SPECTROPHOTOMETRY, SRM 2031 Final Report

R. Mavrodineanu and J. R. Baldwin Apr. 1980 120 p refs (PB80-197486; NBS-SP-260-68; LC-79-600192) Avail: NTIS HC A06/MF A01 CSCL 14B

The selection, production, testing, and certification of the semitransparent evaporated matal on used silica filters as a standard reference material for spectrophotometry are described. Particular attention is given to various factors that can affect the accuracy of the transmittance values established for these filters, such as: reflections; polarization; angle of incidence; and stability in time. Procedures devised are described for the protection of the exposed metal layer surface using optical contact, and for the protection of the filter aggregate, by the use of metal holders provided with shutters and of metal storage containers. The data from several interlaboratory tests are also discussed, together with the results obtained on transmittance measurements on 19 sets of chromium on fused silica filters, protected by optical contact, which were studied over a period of two years. GRA

N81-10137# National Standard Reference Data System.

SELECTED TABLES OF ATOMIC SPECTRA: A: ATOMIC ENERGY LEVELS, SECOND EDITION. B: MULTIPLET TABLES - OV

Charlotte E. Moore May 1980 25 p refs Sponsored in part by NRL

(PB80-197460; NSRDS-NBS-3-Sect-9; LC-64-60074) Avail: NTIS HC A02/MF A01 CSCL 07D

The ninth section of a series being prepared in response to the need for a current revision of two sets of tables containing data on atomic spectra as derived from analysis of optical spectra is presented. As in the previous sections, part A contains the atomic energy levels and part B the multiplet tables. Section 9 includes these data for OV. GRA

N81-10138# *National Bureau of Standards, Washington, D.C. Center for Thermodynamics and Molecular Science.*

THE THERMOCHEMICAL PROPERTIES OF THE URANIUM-HALOGEN CONTAINING COMPOUNDS Interim Report

Vivian B. Parker Jul. 1980 173 p refs Sponsored by International Atomic Energy Agency

(PB80-204605; NBSIR-80-2029) Avail: NTIS HC A08/MF A01 CSCL 07D

An analysis and evaluation of the thermochemistry of the uranium-halogen containing compounds is presented. The properties given, where data are available, are in the enthalpy of formation, delta Hf, Gibbs energy of formation, delta Gf, entropy, S, heat capacity C(p), all at temperature 298.15 K. The analysis of the uranium-halogen containing compounds includes some vaporpressure equations and C(p) equations. Some thermal functions which are not readily available in the accessible open literature are presented in the appendix for compounds that require their use. The tabular summary of delta Hf, delta Gf, includes the values for those uranium compounds which were necessary for this evaluation. GRA

N81-10139# National Bureau of Standards, Washington, D.C. National Measurement Lab.

***STANDARD REFERENCE MATERIALS: A REFERENCE METHOD FOR THE DETERMINATION OF LITHIUM IN SERUM* Final Report**

Rance A. Velapoldi, Robert C. Paule, Robert Schaffer, John Mandel, Lawrence A. Machlan, Ernest L. Garner, and Theodore C. Rains Jul. 1980 119 p refs Prepared in cooperation with Hartford *Hospital, Conn.; New England* Deaconness Hospital, Boston; California Univ., Los Angeles; and Center for Disease Control, Atlanta

(PB80-209117; NBS-SP-260-69; LC-80-600091) Avail: NTIS HC A06/MF A01 CSCL 07D

A reference method was established for the determination of serum lithium based on flame atomic absorption spectroscopy (FAAS). Its accuracy was evaluated by comparing the values obtained by use of the method in 14 laboratories against the results obtained by a definitive analytical method based on isotope dilution mass spectrometry (IDMS). Ten serum pools with lithium concentrations in the range 0.534 to 2.9554 mmol/L were

analyzed. Manual and semiautomated pipetting alternatives were tested using sample sizes of 4.00 and 2.00 mL, respectively. The results showed that the standard error for a single laboratory's bias of about 2.0 percent over the range of serum lithium concentrations studied. The calibration curve data showed excellent linearity over the total concentration range. GRA

N81-10140# National Bureau of Standards, Washington, D.C. National Engineering Lab.
NATIONAL BUREAU OF STANDARD MASS CALIBRATION COMPUTER SOFTWARE Final Report
R. N. Varner and R. C. Raybold Jul. 1980 170 p refs
(PB80-203441; NBS-TN-1127) Avail: NTIS HC A08/MF A01 CSCL 07D

The FORTRAN computer program is described which is used to generate a comprehensive report covering the sequence of operations used to assign mass values to weights submitted to the National Bureau of Standards for calibration. The assignment of these values is accomplished by the method of least squares analysts of the observation of differences between test items and reference items having the same or nearly same density and normal size. The calculations are defined and the various weighing method options are given. The implementation of the computer program is assisted by a flow chart, a description of each subprogram, a cross reference of labeled COMMON, a list of DOUBLE PRECISION variables, a list of EQUIVALENCED variables, and other pertinent information is given. GRA

N81-10141 Duke Univ., Durham, N. C.
A STUDY OF CHANGES IN THE PHYSICAL, CHEMICAL, AND ELECTROCHEMICAL PROPERTIES OF GLASSY CARBON WITH CHEMICAL SURFACE TREATMENTS Ph.D. Thesis
Robert Bach Myers 1980 349 p
Avail: Univ. Microfilms Order No. 8022216

The electrochemical kinetic parameters, i.e., heterogeneous rate constant and transfer coefficient, for the reduction of $Fe(3\pm)$ in sulfuric acid supporting electrolyte were studied for the glassy carbon electrode as a function of electrode surface pretreatment. The parameters were determined using the technique of semiintegral analysis of the faradaic current response to the application of a triangular potential waveform to the electrode. The heterogeneous rate constant was found to depend strongly on the nature of the electrode pretreatment. Application of a drop of chromic acid to the electrode surface followed by a water rinse resulted in a rate constant of 0.00012 cm/sec., while similar treatment with concentrated nitric acid gave a rate constant of 0.00002 cm/sec. The transfer coefficient had a less pronounced dependence on the surface pretreatment. The relationship between electrode surface treatment and electrochemical behavior was further investigated through the study of the physio-chemical nature of the glassy carbon surface as a function of surface treatment. Scanning electron micrographs of the glassy carbon surface revealed evidence of surface heterogeneity, and a lack of surface etching by chromic acid treatment. Taking into account the chemistry of the surface treatment reagents, and the results of the physio-chemical studies outlined above, models of the surface functional groups of glassy carbon were developed. Dissert. Abstr.

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-10142 Wisconsin Univ. - Madison.
FRACTURE BEHAVIOR OF TOOL STEELS Ph.D. Thesis
Shen-Chih Lee 1979 167 p
Avail: Univ. Microfilms Order No. 8015212

The toughness of M-2 high tool steel and H-13 hot work die steel was evaluated by means of the plane strain fracture toughness test, the dynamic tear test, and the Charpy V-notch test. Microstructural characterization was performed by using optical microscopy, scanning electron microscopy and transmission electron microscopy of carbon extractive replica. For M-2 high speed steel, it appears that undissolved carbides are the major microstructural constituents that control crack initiation and hence toughness. For H-13 hot work die steel, toughness was found to be independent of melting process. Single austenitizing about 2100 F dissolved most of the carbides and grain growth occurred. Plain strain toughness remained unchanged in the austenitizing range of 1850-2200 F. dual austeinitizing was found to improve plain strain fracture toughness values substantially. The improvement is believed to be due to the change in carbide morphology. Higher tempering temperature was accomplished by improved toughness for both M-2 and H-13 steels.
Dissert. Abstr.

N81-10143 Washington Univ., St. Louis, Mo.
DEFORMATION AND FRACTURE OF IRON-BASE SOLID SOLUTIONS Ph.D. Thesis
Ellis Ross Bardley 1980 181 p
Avail: Univ. Microfilms Order No. 8026206

The strength and fracture characteristics of dilute iron base alloys following combined mechanical thermal processing was studied. The microstructures of the alloys were examined by optical and transmission electron microscopy for the purpose of establishing the relationships between microscroctures and mechanical properties. Deformation by swaging produced a uniform distribution of equiaxed subgrains. The subgrain size increased with increasing recovery temperature but the subgrain size range was nearly independent of the amount of prior deformation. In contrast to swaging, the dislocation structures in the rolled alloys consisted of bands of elongated subgrains separated by regions of high dislocation density with no apparent subgrain formation. The formation of these deformation bands prevented quantitative characterization of the dislocation substructures. The results indicate that the strength and low temperature fracture charactaristics are controlled by different microstructural features. The dislocation density determines the strength level, whereas the grain structures establish the low temperature fracture characteristics. Dissert. Abstr.

N81-10144 Pennsylvania State Univ., University Park.
CALCINATION REACTION MECHANISMS AND KINETICS IN LEAD ZIRCONATE TITANATE POWDER COMPACTS Ph.D. Thesis
Dana Lynn Hankey 1980 146 p
Avail: Univ. Microfilms Order No. 8024451

The kinetics and basic reaction mechanisms associated with the calcination process of powder compacts of lead zirconate titanate (PZT) piezoceramics were determined. The calcimation reactions sequence was determined for various PZT compositions near the morphotropic phase boundary by using wet chemical techniques, qualitative X-ray diffraction, and differential thermal and thermogravimetric analyses. The sequence is define by the following three endothermic reactions: (1) Pb) + TiO2 PbTiO3,(2) PbO + PbTiO3 + ZrO2 PbOsub ss; (3) PbTiO3 + PbO sub ss + ZrO2 yields. The solid-state reaction kinetics and the activation energies are discussed as well as the effects of particle packing geometry and size variations on the reactivities in the binary systems of PbO:TiO2 and PbO:ZrO2. The techniques for characterizing the raw materials used in the kinetic study are described, with emphasis on crystallite size, crystallite strain, particle size, and specific surface. The dependence of the electromechanical properties of the fired ceramic on calcination conditions is investigated. Dissert. Abstr.

N81-10145 *Connecticut Univ., Storrs.*
X-RAY ABSORPTION STUDY: NOBLE METAL ALLOYS AND THE FILLING OF EMPTY D STATES Ph.D. Thesis
Bernhard Frederick Cordts, III 1980 72 p
Avail: Univ. Microfilms Order No. 8025350

Experimentally measured K and L spectra of copper and nickel in copper-nickel alloys, L spectra of silver and palladium in silver palladium alloys and the L spectra of gold and platinum in one platinum-gold alloy are presented. The spectra are discussed with regard to modern band calculations and their predictions about the unoccupied density of states above the Fermi Level. The sharp contrast between the palladium and nickel L spectra as the noble metal concentration increases is also discussed. The nickel L spectra are discussed in terms of the ferromagnetic behavior of copper nickel alloys. The lack of any absorption

coefficient discontinuities for the M(3) edges of pure gold and platinum are also reported. Dissert. Abstr.

N81-10146 *Missouri Univ. - Columbia.*
A STATISTICALLY BASED ANALYSIS OF THE EFFECTS OF FREQUENCY AND ENVIRONMENT ON THE FATIGUE *CHARACTERISTICS OF SA533B-1 STEEL Ph.D. Thesis*
Gary Charles Salivar 1980 171 p
Avail: Univ. Microfilms Order No. 8024396

The frequency of cyclic loading in a corrosive environment has a significant effect on the fatigue crack propagation characteristics of *many engineering materials. Generally, a decrease in frequency in a particular environment* will cause an increase in the fatigue crack propagation rates. In this experimentation, *three frequency levels and three environments were chosen* to investigate their effects on the fatigue behavior of SA533-3B1-1 steel. A statistically planned experimental program was *conducted and the resulting fatigue crack propagation data were* analyzed using an Analysis of Variance procedure. The data indicate that the effects of the frequency of loading and the *environment are dependent upon each other. A hydrogen* embrittlement mechanism is proposed to explain the increase in the fatigue crack propagation rates. Dissert. Abstr.

N81-10147 Michigan Univ., Ann Arbor.
DISTRIBUTION OF CARBON, NITROGEN, AND OXYGEN IN HEAVY-ION IRRADIATED VANADIUM AND SOME VANADIUM ALLOYS Ph.D. Thesis
Kenneth Stanley Grabowski 1980 154 p
Avail: Univ. Microfilms Order No. 8025689

The depth distribution of C, N, and O was *measured in the* damage layer of a series of heavy ion irradiated samples of V and V alloyed with C, O, N, Cr, or Ti. Ion beam analysis using *simultaneously induced nuclear reactions provided the C, N, and* O distributions to a depth of 2 microns. The profiles were studied as a function of irradiation temperature and displacment dose *produced by MeVV or Ar ions. Displacement dose rates of* 0.003 dpa/s provided peak damage doses of up to 30 dpa, at irradiation temperatures between 250 and 880 C. The dominant effect observed was a large enrichment of C, up to 20 times the bulk C concentration, in the damage zone of most of the *irradiated samples. The C enrichment occurred between 400 and* 700 C, and increased with irradiation dose. A similar enrichment of C occurred on the sample surface over the same temperature *range. The degree of both surface and damage zone C enrichment* was generally greater in V-C alloys and less in V-O and V-N alloys than in unalloyed V. *The addition of Cr to V did not* significantly alter the damage zone enrichment of C, but it did diminish the surface C enrichment. Oxygen enrichment was also *observed in some of the irradiated samples.* Dissert. Abstr.

N81-10148 Michigan Univ., Ann Arbor.
EFFECTS OF MECHANICAL PROPERTIES ON THE DEEP DRAWABILITY OF SHEET METALS Ph.D. Thesis
David Joseph Meuleman 1980 144 p
Avail: Univ. Microfilms Order No. 8025732

The deep drawing behavior of fifty-five materials was studied using the Swift cup drawing test. The resulting limiting drawing ratios (LDR's) were correlated with a variety of mechanical properties to determine any primary or secondary dependence of drawability upon these properties. The average strain ratio, bar R, is the primary property controlling drawability of annealed, cubic metals, but the bar R dependence is lower than that predicted by analytical or numerical analyses. Using a revised anisotropic yield criterion, with an exponent of 4.28 rather than 2.0, with an analytical expression gives a better description of the experimental LDR-bar R trend. Planar plastic anisotropy does not significantly influence drawability when the standard strain ratio averaging formula is used. Of the other mechanical properties, only the work hardening exponent affects the LDR, particularly for work hardening exponents greater than 0.4. Work hardening behavior also strongly influences the final wall thickness of the cup, with high work hardening tending to produce thinner walls. Zinc alloys and as cold rolled metals do not fit the general LDR-bar R trend of the annealed, cubic materials. Dissert. Abstr.

N81-10149# California Univ. at Berkeley. Dept. of Materials Science and Mineral Engineering.
CLUSTER VARIATION STUDY OF ORDERING IN FCC SOLID SOLUTIONS Final Report, 11 Oct. 1976 - 29 Feb. 1980
J. M. Sanchez and D. De. Fontaine Jul. 1980 45 p refs
(Grants DAAG29-77-G-0002; DAAG29-78-G-0058)
(AD-A089208; UCB/ENG-DDF80/01; ARO-14071.7-MS) Avail: NTIS HC A03/MF A01 CSCL 11/6

A systematic approach to the calculation of coherent phase diagrams using high-level approximations of the Cluster Variation Method has been developed. *The emphasis in this investigation was placed in higher than first neighbor* interactions in order to treat the complex ordering observed in the Ni-V and Ni-Mo *systems. The new Cluster Variation approximations, when applied* to the Ising ferromagnet, yielded significant improvement on the results of previous applications of the theory. A new approach *to the Ground State problem including pair and many-body* interactions was also developed. GRA

N81-10150# *Naval Postgraduate School, Monterey, Calif.*
PRECIPITATION, RECOVERY AND RECRYSTALLIZATION UNDER STATIC AND DYNAMIC CONDITIONS FOR HIGH *MAGNESIUM ALUMINUM-MAGNESIUM ALLOYS* M.S. Thesis
Charles Wesley Chesterman, Jr. Mar. 1980 73 p *refs*
(AD-A089283) Avail: NTIS HC A04/MF A01 CSCL 11/6

Previous studies of the mechanical behavior of warm rolled *high magnesium aluminum-magnesium alloys have shown that* excellent tensile properties can be developed in these materials. Several questions raised in these previous efforts regarding *recrystallization and precipitation of the intermetallic beta phase* are addressed in this thesis. It is shown that, for temperatures T less than Ts (where Ts is the *solvus temperature) the only* microstructural change is the precipitation of the beta phase and no crystallization occurs, even with prior cold work. Further *studies of microstructures developed during warm working, with* and without prior cold work, also indicate that precipitation and recovery dominate the microstructural changes in warm rolling *at temperatures below the solvus for the alloy. Recrystallization* will occur readily, but only at temperature in excess of the solvus. Strengthening by warm working, then, occurs by *mechanisms similar to cold work strengthening in solid solution alloys.* GRA

N81-10151# *Materials Sciences Corp., Blue Bell, Pa.*
ELEVATED TEMPERATURE BEHAVIOR OF METAL-MATRIX COMPOSITES Interim Progress Report, 1 Apr. 1979 - 31 Mar. 1980
Zvi Hashin and E. A. Humphreys May 1980 83 p refs
(Contract F49620-79-C-0059; AF Proj. 2307)
(AD-A089414; MSC-TPR-1130/1502; AFOSR-80-0936TR)
Avail: NTIS HC A05/MF A01 CSCL 11/6

An elasto-plastic, temperature-dependent analysis of a graphite/aluminum composite material system was performed. *A hexagonal array model was utilized along with a numerical* analysis procedure. Results for the transversely isotropic material included residual processing effects and stresses, and temperature dependent, one dimensional stress-strain relations, utilizing both isotropic hardening and kinematic hardening assumptions *for aluminum matrix.* GRA

N81-10152# Boeing Military Airplane Development, Seattle, Wash. Advanced Aircraft Branch.
CAST ALUMINUM STRUCTURES TECHNOLOGY (CAST). TECHNOLOGY TRANSFER (PHASE 6) Summary Technical Report
James W. Faber Apr. 1980 255 p refs
(Contract F33615-76-C-3111)
(AD-A087492; D180-25725-1; AFWAL-TR-80-3020) Avail: NTIS HC A12/MF A01

Structural and manufacturing technologies, integrity, producibility, and viability of cast aluminum primary airframe structures are discussed. Preliminary design, manufacturing methods, detailed design, fabrication of demonstration articles and production hardware, structural test evaluation, and technology transfer are included. S.F.

N81-10153# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering
SYNTHESIS OF MICROSTRUCTURES AND THE RELATIONSHIP BETWEEN MICROSTRUCTURE AND PROPERTIES

Final Report, 15 May 1976 - 31 Aug. 1979
Mark E. Rosenblum and Daniel Eylon Mar. 1980 41 p refs (AD-A089602; AFWAL-TR-80-4035) Avail: NTIS HC A03/MF A01 CSCL 11/6

The interrelationships of microstructure, processing and mechanical properties were investigated in several materials. In titanium alloy systems fatigue behavior, high temperature behavior, properties of powder compacts, and the effects of additions of hydrogen were studied. The aluminum research was concerned primarily with powder products and their unique properties. Other areas of investigation included quantitative metallography and fatigue behavior of AF 1410. GRA

N81-10154# Sandia Labs., Albuquerque, N. Mex.
GLASS-TO-METAL SEAL CORROSION IN LITHIUM-SULFUR DIOXIDE CELLS
Bruce C. Bunker, Charles J. Leedecke, Samuel C. Levy, and Chris C. Crafts 1980 20 p refs Presented at 12th Power Sources Conf., Brighton, England, 15 Sep. 1980
(Contract DE-AC04-76DP-00789)
(SAND-79-2156C; CONF-800917-2) Avail: NTIS HC A02/MF A01

Hermetically sealed Li/SO2 cells experience glass corrosion during long term storage of discharge. Premature failure of the cells can result from cracking of the glass with subsequent release of SO2 or from the formation of a low resistance parasitic load across the seal. The corrosion was investigated by placing battery headers containing borosilicate glasses in closed ampules with the acetonitrile-LiBr-SO2 electrolyte. Lithium metal was attached to the outer conductor of the headers to protect the steel case from attack. The corrosion started at the case and progressed toward the pin. Seal failure was predicted when approximately 30 percent of the glass was corroded. An underpotential deposition was used to describe the corrosion. DOE

N81-10155# Oxford Univ. (England). Dept. of Engineering Science.
THE EFFECT OF STRAIN RATE ON THE FLOW AND *FRACTURE OF ALPHA-URANIUM*
J. Huddart and J. Harding Dec. 1979 112 p refs Sponsored by UK Min. of Defence (Procurement Executive)
(OUEL-1304/79) Avail: NTIS HC A06/MF A01

Tensile test at strain rates from 0.0001 to 1000 1/sec were performed on specimens with different fabrication histories and impurity contents ranging from 240 to 650 ppm. At the highest strain rates a marked increase of the rate-sensitivity of the flow stress was observed. Metallographic examination carried out using optical and electron microscopy show a clearly marked ductility transition in the vacuum annealed specimens. The different fracture behavior shown by the various materials in the various heat treatment conditions are explained assuming three fracture mechanisms. Author (ESA)

N81-10156# Centre Technique des Industries Mecaniques, St. Etienne (France).
FORGING APPLICATIONS OF DISPERSOID ALLOYS (EXPLORATORY STUDY) *Final Report [APPLICATION DES ACIERS A DISPERSOIDES A L'ESTAMPAGE (ETUDE EXPLORATOIRE)]*
A. Durand Jan. 1980 31 p refs In FRENCH
(CETIM-1-3K-30-0) Avail: NTIS HC A03/MF A01

The theoretical aspects of dispersoid alloys are discussed together with the following characteristics: hardening by slow cooling and effects of different microalloying elements notably vanadium and niobium. The results of tests carried out on rough rolled 40 mm diameter rods of 48 MV4 alloy are presented. Emphasis is given to chemical composition and metallurgical characteristics before and after forging. It is concluded that a significant gain in strength can be achieved by alloying in this way. Homogeneity characteristics are good. Author (ESA)

N81-10157# Centre Technique des Industries Mecaniques, St. Etienne (France).
STUDY OF GROWTH CONDITIONS AND ELECTRONIC PROPERTIES OF DOUBLE HETEROJUNCTIONS PREPARED IN THE VAPOR PHASE FOR OPTOELECTRONIC APPLICATIONS [LE FIBRAGE ET LES CARACTERISTIQUES MECANIQUES DES PIECES FORGEES]
J. L. Montagut 18 Jan. 1980 49 p refs In FRENCH
(CETIM-1-3X-00-0) Avail: NTIS HC A03/MF A01

The process taking place is defined and examples of typical manifestations are given. Better behavior and longer lifetimes can be obtained by optimizing grain or fiber structure characteristics. It is particularly important to ensure that the fins of joints are positioned outside stress zones. The skin of the part in question must not be decarbonized if a good fiberization is to be retained nor must fibers be allowed to run into the surface at critical zones. These problems can be overcome by appropriate surface treatment; shot peening, nitrogen case-hardening, etc. Practical examples are given. Author (ESA)

N81-10158# Centre Technique des Industries Mecaniques, Senlis (France).
STUDY OF THE CORROSION OF METALLIC MATERIALS PROTECTED BY ORGANIC COATINGS: DEVELOPMENT *OF AN ELECTROCHEMICAL TEST Final Report [ETUDE DE LA CORROSION DES MATERIAUX METALLIQUES PROTEGES PAR REVETEMENTS ORGANIQUES: MISE AU POINT D'UN TEST ELECTROCHIMIQUE]*
Fuvelle and Laroche Sep. 1979 33 p refs In FRENCH
(CETIM-12-C-10-0) Avail: NTIS HC A03/MF A01

A rapid testing method was developed to determine the porosity of organic coatings. A given coating must resist the aggresssivity of the medium to which it is exposed while totally isolating the metallic substrate from this medium. Polarization resistances are measured in this method. The equipment used is described and the results obtained for the behavior of various coatings (glycerophtalic, polyester, etc.) and of coating thicknesses with time are presented. The method is accurate and produces reproducible results. Author (ESA)

N81-10159# *Centre Technique des Industries Mecaniques, Senlis* (France).
BIBLIOGRAPHIC STUDY ON THE SUITABILITY OF CAST *IRON FOR SURFACE TREATMENTS [RECHERCHE BIBLIOGRAPHIQUE SUR L'APTITUDE DES FONTES A RECEVOIR UN TRAITEMENT DE SURFACE]*
F. Mortier and J. J. Sabatier Jan. 1980 11 p refs In FRENCH
(CETIM-12-X-30-0) Avail: NTIS HC A02/MF A01

Emphasis is given to electrolytically deposited surface finishes. The conclusions are drawn that high quality casts free from sand occlusions, surface porosity, carbon module segregation and silicate type inclusions are required. Mechanical precleaning is necessary (vapor blasting, sanding). Predeposit descaling operations must be adapted to the particular type of cast iron employed and its heat treatment. The specific problems and techniques associated with the different deposits envisaged are presented. Author (ESA)

N81-10160*# New Mexico Univ., Albuquerque. Technology Application Center.
HEAT RESISTANT NICKEL ALLOYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE *Progress Report, 1977 - Apr. 1980*
Mary K. Gallagher Jul. 1980 55 p Supersedes NTIS/PS-79/0338 Sponsored by NASA and NTIS
(NASA-CR-163648; PB80-812316; NTIS/PS-79/0338) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

A bibliography containing 153 abstracts addressing heat resistant nickel alloys is presented. Topics covered include the microstructure, mechanical properties, cast alloys, powder metallurgy, precipitation hardening, and heat treatment. GRA

N81-10161*# New England Research Application Center, Storrs, Conn.
TITANIUM: CASTINGS AND CASTING. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE *Progress Report, 1970 - Apr. 1980*
C. Gilbert Young May 1980 86 p Sponsored in part by NTIS
(NASA-CR-163655; PB80-809387) Avail: NTIS HC $30.00/MF $30.00 CSCL 13H

The fabrication through casting of titanium, and various titanium alloys, is covered in 92 cited abstracts. Hot isostatic pressing and other densification techniques are described. A

number of applications and uses of cast titanium parts are included. GRA

N81-10162# National Bureau of Standards, Washington, D.C. Surface Science Div.
PASSIVE FILMS, SURFACE STRUCTURE AND STRESS CORROSION AND CREVICE CORROSION SUSCEPTIBILITY Annual Report, Nov. 1979 - Aug. 1980
J. Kruger, J. J. Ritter, J. J. Carroll, and A. J. Melmed Aug. 1980 52 p refs
(Contract NAONR-18-69; NR Proj. 036-082)
(AD-A089592; NBSIR-80-2101) Avail: NTIS HC A04/MF A01 CSCL 07/4

A feasibility study was made to determine if qualitative ellipsometry can be used together with electrochemical pH and potential measurements as a technique for the study of metal substrates protected by transparent organic coatings. The objective of the work was to gain a deeper understanding of the mechanisms governing the corrosion protective actions of paints on metal surfaces. Computer modeling and experiments with collodion coatings on iron substrates indicated that changes in the ellipsometric parameter could, for the most part, be safely interpreted as thickness alterations in the substrate oxide film. Experiments with the Fe-collodion system in dilute chloride solutions exhibited three sequential stages of activity, two of which could be interpreted in terms of corrosion mechanisms using the optical and electrochemical measurements. Chromate ion as a corrosion inhibitor in coatings was also studied using this technique, and was shown to have significant effects upon the development of the sub-coating processes. GRA

N81-10969# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
SKIN CASTING EXPERIMENTS IN ROCKET FLIGHTS
H. Sprenger (MAN-Neue Technologie, Munich) and K. Schweitzer *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 349-356 ref Sponsored by DFVLR (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10970# Chalmers Univ. of Technology, Goteborg (Sweden).
DIFFUSION EXPERIMENTS ON LIQUID METALS
T. Persson, L. Lindstroem (Micro Nova Corp., Sweden), L. Stenmark (Micro Nova Corp., Sweden), and R. Joesson (Swedish Space Corp., Solna) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 357-362 refs Sponsored by Swedish Board for Space Activities (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-10163 Washington Univ., St. Louis, Mo.
POLYMER BONDING IN NEVER-DRIED FIBER ASSEMBLAGES Ph.D. Thesis
John David Krumpos 1980 127 p
Avail: Univ. Microfilms Order No. 8026260

The reinforcement of wet webs by chitosan was studied to elucidate the mechanism by which web strengthening was achieved so that the impact of various papermaking variables could be estimated. It was proposed that any polymer, which was strongly adsorbed by cellulose and had a large radius of gyration in the web environment, would strengthen a wet web. A modified chitosan and other cationic solutes with molecular weights of less than about 60,000 had little effect on web properties and thus established the minimum effective molecular size. When a cationic polyacrylamide with a molecular weight exceeding that of the unmodified chitosan was utilized, a somewhat greater enhancement of web strength was achieved. Adsorption of chitosan was found to be highly dependent on the solution concentration, pH, and ionic strength. This variation was well described in terms of a reaction between the cationic polymer groups and the anionic fiber groups. In addition, the model suggested that the free energy of adsorption was independent of both polymer concentration and solution pH. Dissert. Abstr.

N81-10164 Pennsylvania State Univ., University Park.
EVAPORATIVE DECOMPOSITION PROCESS FOR THE PRODUCTION OF REACTIVE FINE CERAMIC POWDERS Ph.D. Thesis
Thomas Paul Holleran 1980 134 p
Avail: Univ. Microfilms Order No. 8024477

A novel process for producing reactive fine ceramic powders from aqueous solutions in a single step is described. This process, called evaporative decomposition of solutions (EDS) uses a two fluid atomizer to inject the salt solutions into a vertical hot zone as a mist. Solvent removal and decomposition of the residual salt particles is accomplished in a few seconds to yield highly reactive and homogeneous fine oxide powders. The most significant process parameters are identified and operational limits defined. The interactions of process parameters are examined and the effectiveness of these parameters in controlling the nature of the product is evaluated. A wide range of technological important unary, binary and ternary compositions are illustrated as reactive fine powders produced by EDS. The versatility of the process is shown both in terms of materials applications and its ability to be scaled for either industrial or laboratory application related to existing practice. The EDS process is compared to other processes for producing reactive fine powders, and suggestions are made for future research which could even further extend the range of applications of this versatile process. Dissert. Abstr.

N81-10165 Minnesota Univ., Minneapolis.
STUDY OF POLYMER SOLVENT INTERACTIONS IN THE SYSTEM POLY(ETHYLACRYLATE)/CHLOROFORM BY NMR Ph.D. Thesis
Lenas Joseph Hedlund 1980 214 p
Avail: Univ. Microfilms Order No. 8025452

Nuclear magnetic resonance spectroscopy was used to probe the solvent polymer interactions in the system poly(ethyl) methacrylate)/chloroform. Nuclear relaxation studies were conducted throughout the range of composition, particularly in the case of the solvent. To obtain information at the limit of high polymer concentration, a special carbon-13 NMR probe incorporating magic angle spinning and dipolar decoupling was constructed. Carbon-13 relaxation data were obtianed for the solvent and the polymer, along with proton and deuterium relaxation data for the solvent. As polymer concentration was raised the solvent-polymer interaction totally dominated the proton relaxation behavior of the solvent. Solvent-solvent and solvent-polymer relaxation rates tend to indicate the replacement of weaker solvent-solvent interactions with stronger solvent-polymer interactions. All solvent relaxation times are shown to be concentration dependent, decreasing systematically with the addition of polymer. Dissert. Abstr.

N81-10166 Houston Univ., Tex.
STUDIES OF BIODETERIORATION OF METAL WORKING FLUIDS Ph.D. Thesis
Ikemefuna Uzo Onyekwelu 1980 117 p
Avail: Univ. Microfilms Order No. 8025015

Of the twenty triazole compounds studied, benzotriazole, 5-chloro benzotriazole and tolytriazole have very good antimicrobial properties in specialty lubricants tested, and this property was potentiated by EDTA. Of the thirty-three morpholine compounds studied methylene dimorpholine, N-aminomorpholine, N-(2-chloroethyl) morpholine, N-(aminopropyl) morphine, 2-nitrobutyl morpholine and morpholine borane have good antimicrobial properties, but this activity was greatly reduced when morpholine compounds were mixed with formaldehyde releasers. Inhibitory properties of Dowicide A Milidin TI-10 and Dowicil 75 were enhanced by filtering agents like cellulose in petroleum base products. On synthetic and semisynthetic coolants bentonite, diatomaceous earth, and cellulose increased the activities of Proxel CRL, Dowicide A and Sodium Omodine. Only the inhibitory properties of Tris Nitro were reduced by filtering agents in all three classes of coolants. Mixing preservatives and cutting fluid

concentrates resulted in marked decrease in antimicrobial properties of the preservatives. Dissert. Abstr.

N81-10167 Rochester Univ., N. Y.
KINETICS OF RECOVERY OF ATACTIC POLYSTYRENE Ph.D. Thesis
Benjamin Tai-An Chang 1980 117 p
Avail: Univ. Microfilms Order No. 8023915

The dimensional and thermal stability of polymers are discussed. For the dimensional stability, the strain introduced by surface indentation or by compression was recoverable upon heating. The kinetics for isothermal strain recovery were studied. The isothermal variation of both the indentation depth and the specimen length was found to obey second order kinetics at least for the later stage of recovery. For the thermal stability both cold work and quenching introduce excess enthalpy into polymers which can be released upon heating. The isothermal release of excess enthalpy due to quenching at temperatures below 100 degrees C was found to follow second order kinetics. The activation enthalpy associated with the second order rate constant was 200 Kcal/mole in the temperature range between 91 and 101 C. The activation enthalpy for the release of stored enthalpy by cold work (compression) obtained from the shift of peak temperature with heating rate was 142 Kcal/mole in the temperature range of 108 to 115 C. The second order kinetics could be due to the annihilation of defects of opposite signs. Dissert. Abstr.

N81-10168 Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.
ELASTOMERS USED IN AERONAUTICS INDUSTRY [LES ELASTOMERES UTILISES DANS L'INDUSTRIE AERONAUTIQUE]
G. Dallemagne Paris 11 Jun. 1980 25 p In FRENCH Presented at Stage Mater. Nonmetal., Jun. 1980
(SNIAS-801-551-105) Avail: NTIS HC A02

The physicochemical structure of elastomers is briefly examined. The performance of various elastomers under specific conditions is given. Their uses in various aircraft components and systems are discussed. Classification and standardization procedures are exposed together with the testing equipment employed and the results obtained. Author (ESA)

N81-10169*# Ultrasystems, Inc., Irvine, Calif.
PHOSPHAZENE DIAMINES Contractor Report, Jun. 1979 - Apr. 1980
K. L. Paciorek, D. H. Harris, T. I. Ito, and R. H. Kratzer Oct. 1980 61 p refs
(Contract NAS3-22019)
(NASA-CR-165147; SN-8342-F) Avail: NTIS HC A04/MF A01 CSCL 11G

The synthesis of a specific phosphazene diamine was optimized, other phosphorus-containing diamines were prepared, and their effect upon certain characteristics of epoxy resins, prepared via reaction with MY 720, in particular, char yield at elevated temperatures was evaluated. The synthesis of the phosphazene diamine resulting from the interaction of methylenedianline with 4,4'-bis(diphenylphosphino)biphenyl was simplified into a one step process giving 77 percent yield of the pure product. Using this procedure, a related diamine containing bis(diphenylphosphino)methane was obtained in a 70 percent yield. Preparation of another class of phosphorus containing amines based upon p-aminophenyldiphenyl-phosphine was unsuccessful; the inability to produce p-aminophenylithlum was responsible for this failure. Seven epoxy resins employing Araldite MY 720, diaminodiphenylsulfone, and two of the phosphorus containing diamines were prepared, characterized, and their char yield capacity at elevated temperatures assessed. Based on these investigations, the resins containing phosphorus appear to exhibit significantly better char formation characteristics than materials hardened using conventional amines, without impairing the other properties measured. R.K.G.

N81-10170*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF SUBSTRATE SURFACE FINISH ON THE LUBRICATION AND FAILURE MECHANISMS OF MOLYBDENUM DISULFIDE FILMS
Robert L. Fusaro 1980 40 p refs Proposed for presentation at Annual Meeting of the Am. Soc. of Lubrication Engr., Pittsburg, 11-14 May 1981
(NASA-TM-81595; E-9715) Avail: NTIS HC A03/MF A01 CSCL 11H

An optical microscope was used to study the lubrication and failure mechanisms of rubbed (burnished) MoS2 films applied to three substrate surface finishes - polished, sanded, and sandblasted - as a function of sliding distance. The lubrication mechanism was the plastic flow of thin films of MoS2 between flat plateaus on the rider and on the metallic substrate. If the substrates were rough, flat plateaus were created during 'run in' and the MoS2 flowed across them. Wear life was extended by increasing surface roughness since valleys in the roughened substrate served as reservoirs for MoS2 and a deposit site for wear debris. In moist air, the failure mechanism was the transformation of metallic colored MoS2 films to a black, powdery material that was found by X ray diffraction to consist primarily of alpha iron and MoO3 powders. In dry argon, the failure mechanism was the gradual depletion of the MoS2 film from the contact region by transverse flow. Analysis of the wear debris on the wear track at failure showed it consisted mainly of alpha iron and some residual MoS2. No molybdenum oxides were found. M.G.

N81-10171# Illinois Univ. at Urbana. School of Chemical Sciences.
IONIC ATTACHMENT AS A FEASIBLE APPROACH TO HETEROGENIZING ANIONIC SOLUTION CATALYSTS: THE CARBONYLATION OF METHANOL
Russell S. Drago, Eric D. Nyberg, Anton ElAmma, and Alan Zombeck 1 Aug. 1980 20 p refs
(Contract N00014-78-C-0245)
(AD-A088888; ONR-TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

Few definitive examples of ionically supported anionic transition metal complexes for use in catalysis have been reported, even though there are several advantages to be gained from such systems. To demonstrate the feasibility and usefulness of such materials in catalysis, we investigated the (Rh(CO)2I2)-catalyzed carbonylation of methanol to acetic acid. The ionically supported (Rh(CO)2I2)species was found to be equal in catalytic activity to the homogeneous complex, and leaching of the catalyst could be eliminated by suitable choice of solvent and resin/rhodium ratios. Additionally, we investigated the usefulness of a solid phase acid in catalyzing the formation of CH3I from NaI (NaI by itself is inactive). We found this acid catalyst was active in this regard, and that the acidity was retained within the solid phase. These experiments suggest a general application of anion exchange resins as a mechanistic tool for detecting catalysis by anionic species in homogeneous processes. GRA

N81-10172# Dayton Univ., Ohio. Research Inst.
A STUDY TO DETERMINE THE EFFECT OF GLASS COMPOSITIONAL VARIATIONS ON VIBRATION DAMPING PROPERTIES Final Technical Report, 15 Jan. 1976 - 31 Mar. 1980
George A. Graves, Jr., Charles Cannon, and Binod Kumar May 1980 174 p refs
(Contract F33615-76-C-5137; AF Proj. 7351)
(AD-A089499; UDR-TR-80-27; AFWAL-TR-80-4061) Avail: NTIS HC A08/MF A01 CSCL 11/3

This report describes the results of an experimental investigation to determine the effects certain oxide additions have on the damping properties of a commercial glass (enamel) of known composition (Corning 0010) whose damping properties had previously been characterized. One of the aims of this investigation was to determine the effect the oxide additions had on the temperature at which peak damping occurred, singly and in combination. Past experience indicated the temperature of peak damping to be related to the viscosity of the glass. The results of this investigation indicated the temperature at which peak damping occurs (peak in the loss modulus curve) is related to the viscosity of the glass. Additions which made the glass more refractory (increased the viscosity of the glass) increased the temperature at which peak damping occurred. Additions which made the glass less refractory (lowered the viscosity of the glass) lowered the temperature at which peak damping occurred. The

results of the investigation are presented in tabular and graphical form. GRA

N81-10173# Oak Ridge National Lab., Tenn.
SCLEROGLUCAN BIOPOLYMER PRODUCTION, PROPERTIES AND ECONOMICS
A. L. Compere and W. L. Griffith 1980 7 p refs Presented at the 6th Intern. Ferment. Symp. and 5th Intern. Symp. on Yeasts, London and Ontario, Canada, 20 Jul. 1980
(Contract W-7405-eng-26)
(CONF-800739-1) Avail: NTIS HC A02/MF A01

Production and solution properties which may make scleroglucan polysaccharide economically advantageous for onsite production and use in tertiary oil recovery were investigated. Scleroglucan, which is similar in viscosity and shear thinning to xanthan, can be produced in a 3 day batch or 12 h continuous fermentation. Yield is nearly 50 percent based on input glucose. Gross biopolymer biomass separation may be effected using microscreening, a low energy process, followed by polish filtration. Polymer flux may be improved by hydrolysis with an endolaminarinase from Rhizopus arrhizius QM 1032. Simple feedstock requirements and low growth pH, together with the difficulty of resuspending dried polymer, may encourage field biopolymer fermentation and use of purified culture broth. DOE

N81-10174# British Plastics Federation, London (England).
THE WEATHERING OF PLASTICS MATERIALS IN THE TROPICS. PART 4: POLYSULPHONE
Dec. 1979 40 p refs
(BR71433-Pt-4) Avail: NTIS HC A03/MF A01

The effect of long term weathering on polysulphone is described. Both unpigmented samples and samples containing carbon black were exposed for up to 4 years at two tropical and one temperate sites. Visual appearance, weight, tensile and flexural strength and electrical properties were recorded and used to monitor the effects of weathering on polysulphone. Unpigmented samples were found to embrittle rapidly while carbon black filled samples showed no loss of flexural strength and losses of ductility smaller than those observed with the natural material. Author (ESA)

N81-10175# New York State Coll. of Ceramics, Alfred.
POSSIBLE USES OF MANGANESE DIOXIDE IN CERAMIC APPLICATIONS: LITERATURE REVIEW AND ANALYSIS Research Report, 2 Aug. 1979 - 1 Jan. 1980
David R. Rossington 11 Feb. 1980 71 p refs
(Contract DI-BU-J0199130)
(PB80-192214; BUMINES-OFR-68-80) Avail: NTIS HC A04/MF A01 CSCL 11C

A literature review of current uses of MnO2 and suggestions for future research are presented. The historical background, oceanographic distribution, geology, exploitation, law, and politics of MnO2 are included. Uses of MnO2 in ferrites, semiconductors, catalytic processes, thermoluminescence, and photochromic materials are presented. A select bibliography of 33 items and 129 references is presented at the end of the report. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-10176 Pennsylvania State Univ., University Park.
A NUMERICAL AND EXPERIMENTAL INVESTIGATION OF RAPID COAL PYROLYSIS Ph.D. Thesis
James Daniel Frehaut 1980 210 p
Avail: Univ. Microfilms Order No. 8024446

The degree of coupling possible between thermal transport and chemical kinetic phenomena during rapid coal pyrolysis was investigated. Three possible modes of pyrolysis are considered: simple chemical control; coupled interphase thermal transport and chemical kinetics; and coupled intraphase thermal transport and chemical kinetics. A systematic variation of associated chemical and physical parameters is performed within each case to determine the degree of sensitivity of the pyrolysis process to changes in each parameter. It was found that the mode of heat transport to the particle, particle size and intrinsic pyrolytic reactivity can be strongly coupled under a wide variety of parameter combinations. A differential reactor was designed to rapidly devolatilize coal particles of widely different sizes. The shapes of the differential curves obtained were compared to those obtained in the numerical investigatigation of rapid pyrolysis. Dissert. Abstr.

N81-10177 Brigham Young Univ., Provo, Utah.
MIXING AND GASIFICATION OF PULVERIZED COAL Ph.D. Thesis
Frederick Douglas Skinner 1980 248 p
Avail: Univ. Microfilms Order No. 8025617

An entrained gasifier was developed to investigate the local details of pulverized coal gasification. A series of experiments were completed in which the operating characteristics of the reactor were determined at atmospheric pressure. Gas and particle samples were obtained from inside the reactor at various radial locations near the reactor exit with water quench probes. The effect of reactant mixture ratios on carbon conversion. H2/CO ratio, CO2/CO ratio and coal-gas heating value were deduced. A second series of experiments were conducted wherein radial gas and particle composition profiles were obtained at several axial locations within the reactor. The extents of particle reaction and elemental acoal component release were measured. A method was developed by which local concentrations of steam could be calculated. For the given flow conditions, gas mixing was complete at about 2/3 of the distance down the reactor, while the particles were not totally dispersed within the length of the reactor. Coal burnout near the reactor exit was about 57%. Dissert. Abstr.

N81-10178# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
EXPECTED DETECTION LIMITS OF HYDRAZINE-BASED ROCKET FUELS AND THEIR SELECTED OXIDATION PRODUCTS BY C-12O2-16 LASER SPECTROSCOPIC TECHNIQUES Interim Report
G. L. Loper, A. R. Calloway, M. A. Stamps, and J. A. Gelbwachs 15 Aug. 1980 78 p refs
(AD-A089608; TR-0080(5970-09)1; SD-TR-80-55) Avail: NTIS HC A05/MF A01 CSCL 21/9

This report details the progress of the effort toward the development of CO2 laser spectroscopic techniques for the detection of trace airborne levels of toxic hydrazine-based rocket fuels and some of their potentially toxic air oxidation products. The health hazards to humans resulting from exposure to these compounds, even at very low concentrations, are of increasingly great concern. The Air Force needs improved detection techniques that will permit these compounds to be monitored on a real-time basis down to the 30 part-per-billion (ppb) level in the ambient air near hydrazine-fuel production and storage facilities and at missile launch sites. GRA

N81-10179# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE SELF LIFE OF FUELS WHICH ARE INTENDED FOR CLASSICAL AND ROCKET ARMAMENTS
Milos Colakovic Aug. 1980 18 p refs Transl. into ENGLISH from Navcno-Teh. Pregl. (Yugoslavia), v. 29, no. 2, 1979 p 18-25
(AD-A089586; FTD-ID(RS)T-1044-80) Avail: NTIS HC A02/MF A01 CSCL 21/9

Survey was made of achievements in the area of forecasting safe storage and exploitation of solid fuels. Particular attention was given to rocket powder, which represented the most critical part of the system. Its specific composition, form, and grain size established a convenient basis for the creation of defects which may bring about disastrous consequences during the exploitation process. R.C.T.

N81-10180# Kansas Energy Office, Topeka.
COGENERATION OF ETHANOL FROM I.C. ENGINE POWER PLANTS
Randall Noon 1980 9 p refs
(NP-24437) Avail: NTIS HC A02/MF A01

Internal combustion engine power plants have significant and suitable waste heat for the production of ethanol. Such power plants are often located in conjunction with cattle and grain producing areas, two of the important ingredients for ethanol production. Cogeneration of ethanol from I.C. engines will afford significant production of ethanol without requiring more fuel than is currently used. A one megawatt peak electrical output rated I.C. engine could produce 250,000 gallons of anhydrous ethanol per year. DOE

N81-10181# Rockwell International Corp., Canoga Park, Calif. Environment and Energy Systems Div.
PARTIAL LIQUEFACTION OF COAL BY DIRECT HYDROGENERATION Quarterly Progress Report, Jul. - Sep. 1979
A. Y. Falk 1979 21 p
(Contract EX-76-C-01-2044)
(FE-2044-49) Avail: NTIS HC A02/MF A01

Seven additional reactor tests were made in the 1 TPH PDU; five of these were greater than 1 hour in duration. Twenty one tests were made with the PDU since the installation of the high pressure product recovery system. The carbon balances for the longer duration tests approach approximately 95 percent. Several operational and hardware problems were encountered and solved. Excessive char carryover into the liquid product recovery system was observed on several of the tests. By limiting the coal flow rates of less than 1500 lbm, char carryover is not a problem. The gas side main injector injection pressure drop was steadily increasing with continued use of the indicator. After approximately 60 tests, the injector had suffered some heat induced distortion which caused the increased pressure drop. Installation and checkout of the water cooled heat recovery quench unit was completed and testing is in progress. DOE

N81-10182# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
DEUTERIUM TRACER METHOD FOR INVESTIGATING THE CHEMISTRY OF COAL LIQUEFACTION Quarterly Technical Progress Report, Oct. - Dec. 1979
R. P. Skowronski, J. J. Ratto, and L. A. Heredy Jan. 1980 40 p refs
(Contract DE-AC01-77ET-11418)
(FE-2781-5) Avail: NTIS HC A03/MF A01

The deuterium tracer method which provides information on where the hydrogen is incorporated into the coal structure during hydrogenation, is discussed. Emphasis is placed upon donor solvent coal hydrogenation. Tetralin or tetralin-d sub 12 in a protium, deuterium, or nitrogen atmosphere, was used to elucidate the roles of gas phase and solvent hydrogen. Experiments were conducted with (1) fully deuterated solvent and protium gas, (2) fully deuterated solvent and nitrogen, and (3) the all-protium form of the solvent with deuterium gas. Coal injection and rapid cooldown techniques were used to provide a well defined reaction time. The combined solid and liquid products were solvent fractionated into oil, asphaltene, preasphaltene, and residue portions. These fractions were analyzed to determine the amount of deuterium incorporated and the structural positions of the incorporation. Also, the elemental compositions of the fractions were determined. The gas phase products were analyzed for molar and isotopic compositions. DOE

N81-10183# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
DEUTERIUM TRACER METHOD FOR INVESTIGATING THE CHEMISTRY OF COAL LIQUEFACTION Quarterly Technical Progress Report, Jan. - Mar. 1980
R. P. Skowronski, J. J. Ratto, I. B. Goldberg, and L. A. Heredy Apr. 1980 54 p refs
(Contract DE-AC01-77ET-11418)
(FE-2781-6) Avail: NTIS HC A04/MF A01

The deuterium tracer method is used to investigate donor solvent coal hydrogenation. Tetralin or tetralin-d sub 12 in a protium, deuterium, or nitrogen atmosphere was used to elucidate the roles of gas phase and solvent hydrogen in donor solvent coal hydrogenation. The coal products from these experiments show preferential deuterium incorporation in alpha-aliphatic and aromatic positions; the structural position least susceptible to deuterium incorporation is the beta-aliphatic position. On the basis of the results, it is clear that hydrogen from the gas phase is incorporated into the donor solvent. The results suggest that the alipha-alphatic radical of the tetralin may act to channel gas phase hydrogen into the coal during liquefaction. DOE

N81-10184# Midwest Research Inst., Golden, Colo.
LIGHT-DEPENDENT HYDROGEN PRODUCTION
C. Reinhardi, Stephen Lien, Charles McBride, Robert Togasaki, and Anthony SanDietro 1979 9 p refs Presented at the ISES Meeting, Atlanta, 28 May 1979 Prepared in cooperation with Indiana Univ., Bloomington
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042; Grants NSF BMS-75-03415; NSF AER-75-16962)
(CONF-790541-63) Avail: NTIS HC A02/MF A01

Rapidly growing cultures (exponential phase) exhibited lower hydrogenase activity than early stationary cultures. During prolonged dark anearobic incubation the hydrogenase activity attained a maximal value in two to five hours. The activity declined rapidly after three to four hours of anaerobic incubation unless the pH of the suspending medium was maintained above 6.0. In C. reinhardi (strain 137 c) the source of electrons for hydrogen photoproduction appeared to be derived mainly from water oxidation. However, when the water splitting complex of photosystem II was impaired by a mutational block, the organism can utilized intracellular organic reductants as substrate for H2 production in a light-dependent reaction involving both PSII and PS1. DOE

N81-10185# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
SOLAR THERMAL HYDROGEN PRODUCTION PROCESS Annual Technical Progress Report, Jan. - Dec. 1979
G. H. Parker 1979 217 p refs
(Contract ET-78-C-02-4705)
(COO-4705-34) Avail: NTIS HC A10/MF A01

Operational studies were conducted and have resulted in definitions of operating modes for solar/hydrogen plants and in assessments of the day/night and annual variations in performance that will influence the operating modes and the sizing of plant subsystems. Conceptual design studies were conducted for process components that interface with the solar receiver. From related trade off studies, a preferred configuration emerged that involves an intermediate working fluid (e.g., hot gas) between the solar receiver and the sulfuric acid decomposition reactor. The design of the reactor was based on a shell and tube type heat exchanger configuration with catalyst placement on the shell side. A number of candidate materials for structural use in the acid decomposition reactor also were evaluated experimentally. Approximately three dozen candidate materials for use in constructing the acid vaporizer were tested for corrosion resistance. Discussions of the results obtained during 1979 are presented. DOE

N81-10186# UOP, Inc., Des Plaines, Ill. Corporate Research Center.
UPGRADING OF COAL LIQUIDS: HYDROTREATING AND FLUID CATALYTIC CRACKING OF SRC-2 PROCESS DERIVED GAS OILS Interim Report
F. J. Riedl and A. J. deRosset Jul. 1980 88 p
(Contract DE-AC01-77ET-10131)
(FE-2566-39) Avail: NTIS HC A05/MF A01

Four different fluid catalytic cracking (FCC) feedstocks, ranging in hydrogen content from 8.66 to 10.59 wt percent were prepared by topping the raw SRC-II gas oil and hydrotreated SRC-II products to remove 400 F minus material. Rerunning the raw SRC-II feed to remove 5.2 wt percent of the bottoms removed most of the heptane insolubles and Conradon carbon precursor. Results of fluid caralytic cracking showed that feed hydrogen content is a dominant factor in conversion and yield structure. As the feed hydrogen content increased, both conversion and gasoline yield increaased, and carbon deposited decreased. In the range of conditions investigated, gasoline research octane numbers of 97.5 to 106.7 were obtained. The yields of 650 F minus distillates generated were as high as 93 vol percent. It is concluded that SRC-II gas oil, or other coal derived distillate of similar quality, can be processed into high quality gasoline by use of current hydrotreating and FCC technology. DOE

N81-10187# California Univ., Livermore. Lawrence Livermore Lab.

MOTOR FUELS AND SNG FROM COAL
H. Hiller 1980 26 p refs Transl. into ENGLISH from Erdoel-Erdgas Z., (West Germany) no. 96, 1980 p 76-80
(UCRL-Trans-11604) Avail: NTIS HC A03/MF A01

The classical coal-conversion processes for the production of motor fuels must be adapted to present economic and production conditions. Only the process sequence for Fischer-Tropsch synthesis plants has undergone continuous further development, stimulated by the existence of large industrial plants in this sector. Recently, methanol synthesis based on coal gasification and followed by gasoline synthesis has become possible on a large industrial scale. The economy of the various processes for converting coal to motor fuels and SNG is compared. It is observed that there are proven conversion processes which guarantee competitive supplies in view of the price trend in the crude-oil market. Immediate construction of such plants to reduce the dependence of West Germany on crude-oil supplies is advisable. DOE

N81-10188# Institute of Gas Technology, Chicago, Ill.
PREPARATION OF A COAL CONVERSION SYSTEMS TECHNICAL DATA BOOK
A. T. Talwalkar and W. W. Bodle (DOE) 1980 21 p refs Presented at the 88th Natl. Meeting, AICE Conf., Philadelphia, 8-12 Jun. 1980
(Contracts DE-AC01-76ET-10251; EX-76-C-01-2286)
(CONF-800610-9) Avail: NTIS HC A02/MF A01

The purpose of the Data Book is to compile, evaluate and correlate data in the fields of coal conversion and utilization (except for direct combustion) generated under various DOE projects or otherwise available. These prepared data are to be presented in forms useful to engineers and scientists engaged in developments within the emerging coal conversion and utilization industry. The Data Book is being prepared in a loose-leaf form that can be updated at regular intervals. This is not a research project but rather a critical review and evaluation of existing information, correlations, and design techniques as well as compilation of necessary data. This continuing project also brings into focus areas where needed technical data are lacking. In the preparation of this Data Book, IGT and DOE are making every effort to obtain inputs from potential users and to this end have the benefit of a volunteer industrial consultant group to review the Data Book program, progress, and priorities. DOE

N81-10189# Pennsylvania Univ., Philadelphia. Dept. of Chemical and Biochemical Engineering.
BIOLOGICAL PRODUCTION OF LIQUID FUELS FROM BIOMASS Annual Report, 1 Sep. 1978 - 31 Aug. 1979
E. Kenneth Pye and Arthur E. Humphrey 1979 113 p refs
(Contract EY-76-S-02-4070)
(COO-4070-11) Avail: NTIS HC A06/MF A01

The production of liquid fuels from renewable resources such as popular wood and lignocellulosic wastes from a refuse hydropulper were studied. The particular scheme being studied involves the conversion of a cellulosic residue, resulting from a solvent delignified lignocellulosic feed, into either high concentration sugar syrups or into ethyl and/or butyl alcohol. The process is aimed at achieving total raw material utilization and maximization of high value by-product recovery. Specific goals of the investigation are the demonstration of the process technical feasibility and economic practicality and its optimization for maximum economic yield and efficiency. The construction of a pilot apparatus for solvent delignifying 150g samples of lignocellulosic feeds was completed. Also, an analysis method for characterizing the delignified product was selected and tested. Delignified samples are being prepared and tested for their extent of delignification and susceptibility to enzyme hydrolysis. DOE

N81-10190# Oak Ridge National Lab., Tenn. Chemistry Div.
STRUCTURE AND CHEMISTRY OF COALS: CALORIMETRIC ANALYSES
E. L. Fuller, Jr. 1979 19 p refs Presented at the 54th Colloid and Surface Symp., Bethlehem, Pa., Jun. 1979
(Contract W-7405-eng-26)
(CONF-7906177-1) Avail: NTIS HC A02/MF A01

Heats of immersion (h/sub i/) of coals was shown to be a valuable means of investigating structure and chemistry of coals. Lower ranked coals imbibe more liquids (i.e., H2O) onto more polar sites (carbonyl, phenolic, etc.) than higher ranked coals. Mineral matter reacts strongly with polar liquids (i.e., H2O) giving rise to enhanced h/sub i/. Grinding of coals not only decreases particle size but modifies the coal structure to an increasing degree dependent upon the extent and severity of grinding. The magnitude of h/sub i/ and the rate of reaction are both modified consistent with the existence of a shrinking core or unperturbed coal structure serving as substrate to which the modified (less ordered) material is bound. Chemical (alkali) attack seems to loosen the coal structure markedly to allow enhanced access to fluid reagents. These exploratory studies have shown that calorimetric analyses are excellent means for elucidating the structure and chemistry of coals and related materials. DOE

N81-10191# California Univ., Livermore. Lawrence Livermore Lab.
POTENTIAL METHODS FOR METHANE EXTRACTION FROM GEOPRESSURED BRINE AT HIGH TEMPERATURE AND PRESSURE
R. Quong, L. B. Owen, and F. E. Locke 2 Jun. 1980 19 p refs Presented at The Petrol. Eng. of AIME 55th Ann. Tech. Conf. and Exhibition, Dallas, 21-24 Sep. 1980
(Contract W-7405-eng-48)
(UCRL-84064; CONF-800931-1) Avail: NTIS HC A02/MF A01

Methods for extracting methane at high pressures and temperatures are being devised. Liquid extraction with a very low water soluble organic is a technically feasible method. A candidate solvent is hexadecane, a paraffinic hydrocarbon with the necessary phase equilibrium thermodynamic properties to satisfy the technical requirements for such an operation, without any obvious economic barriers. Gas stripping is another technically feasible method, but the economics do not look favorable because of gas dissolution losses. Freon refrigerants were considered because of their ease of product stripping gas separation and nitrogen was considered because of its low cost. Brine driven positive displacement pumps with provisions for methane exsolution are technically feasible concepts and could eliminate or greatly reduce pump power costs. These extraction operations will not preclude the option of recovering the thermal energy component, if desired. DOE

N81-10192# Carnegie-Mellon Inst. of Research, Pittsburgh, Pa.
DESIGN AND SIMULATION OF A RECIRCULATING BED REACTOR FOR COAL HYDROGASIFICATION. PART 1: RECIRCULATING BED HYDROGASIFIER CONCEPTUAL DESIGN AND SIMULATION RESULTS Final Report
Thomas W. Bierl, Lawrence J. Bajdos, and Alan E. McCiver Mar. 1980 259 p refs
(Contracts DE-AS01-78ET-13336; ET-78-S-01-3031)
(FE-3031-5-Pt-1) Avail: NTIS HC A12/MF A01

A conceptual design of a recirculating bed hydrogasifier is presented. The reactor was designed to operate at 1800 F and 44 atm on hydrogen, and it would convert 63% of coal carbon. A mechanical design is presented which utilizes U-bend crossovers, a unique mechanism for controlling loop pressure balance and a dense phase coal injector for direct addition of agglomerating coals. DOE

N81-10193# Department of Energy, Bartlesville, Okla. Bartlesville Energy Technology Center.
LIQUID FOSSIL FUEL TECHNOLOGY Quarterly Technical Progress Report, Oct. - Dec. 1979
Apr. 1980 56 p refs
(DOE/BETC/QPR-79/4) Avail: NTIS HC A04/MF A01

Activities and progress are reported in: liquid fossil fuel cycle, extraction (enhanced recovery of oil and gas), processing (of petroleum and alternate fuels), utilization (transportation and energy conversion), and systems integration. Bartlesville Energy Technology Center publications and finances are listed in appendices. DOE

N81-10194# Department of Energy, Washington, D. C. Gasohol Study Group.
REPORT OF THE ENERGY RESEARCH ADVISORY BOARD ON GASOHOL
29 Apr. 1980 37 p refs

(DOE/TIC-11238) Avail: NTIS HC A03/MF A01

Ethanol production as a near term (mid 1980's) partial solution to the liquid fuels problem (based on current incentives) will probably reach 200 to 300 million gallons per year by 1985. Thereafter, about 800 million gallons of ethanol could be produced per year. This level of ethanol production would displace an equivalent of 26,000 barrels of oil per day or less than one percent of US gasoline consumption; and utilizing the best available technology before 1985 the net energy balance is about zero for ethanol produced from corn and other crops in fermentation/distillation plants. If the fermentation/distillation plants are fueled by coal or wood, each gallon of ethanol produced could save roughly 0.5 gallons of oil. DOE

N81-10195# Engineering Societies Commission on Energy, Inc., Washington, D. C.

MATERIALS FOR COAL CONVERSION AND USE. VOLUME 3: MATERIALS OF CONSTRUCTION FOR ADVANCED POWER SYSTEMS Final Report

Vinod K. Nangia Aug. 1980 86 p refs

(Contract DE-AC01-77ET-10679; EF-77-C-01-2468)

(FE-2468-71-Vol-3) Avail: NTIS HC A05/MF A01

Two advanced coal based power generation systems and their materials related problems are described. The first system is an integrated coal gasifier-molten carbonate fuel cell power plant with a steam turbine/gas turbine bottoming cycle. The second is a combined cycle power plant using a pressurized fluidized bed coal combustor. E.D.K.

N81-10196# TRW, Inc., McLean, Va. Energy Systems Planning Div.

METHANE RECOVERY FROM COALBEDS PROJECT Monthly Progress Report

Jun. 1980 104 p

(Contract DE-AC21-78MC-08089)

(DOE/MC-08089/T12) Avail: NTIS HC A06/MF A01

Performance and wear characteristics of turbodrill testing are discussed. Development and demonstration of a system for the recovery of methane from anthracite coal using stimulated multiple and multiple completion wells are reported. Problems with the dewatering pump are mentioned. A technique for coal stimulation is evaluated and results of coal core analyses are presented. R.K.G.

N81-10197# Exxon Research and Engineering Co., Florham Park, N.J.

EDS COAL LIQUEFACTION PROCESS DEVELOPMENT, PHASE 5 Monthly Technical Progress Report, 1 Jun. - 30 Jun. 1980

W. R. Epperly Jul. 1980 54 p Sponsored in part by Exxon Co., Electric Power Research Inst., Japan Coal Liquefaction Development Co., Phillips Petroleum Co., ARCO Coal Co. and Ruhrkohle AG.

(Contracts DE-FC01-77ET-10069; EF-77-A-01-2893)

(FE-2893-52) Avail: NTIS HC A04/MF A01

High pressure bottoms recycle operations were conducted on the 50 pounds/day Recycle Coal Liquefaction Unit with Texas lignite. Significant conversion, yield and unit operability advantages can be obtained with lignnite by operating in the bottoms recycle mode, as compared to coal only operation. The impact of high pressure bottoms recycle on the relative economics of various bottoms processing options was studied. Various methods of calculating the Required Initial Selling Price of coal liquids were examined. DOE

N81-10198# General Electric Co., Schenectady, N. Y. Energy Technology Operations.

TEXACO-BASED GASIFICATION-COMBINED-CYCLE SYSTEM PERFORMANCE STUDIES Final Report

J. J. Olova and S. D. Shemo Jun. 1980 167 p refs

(EPRI Proj. 986-3)

(EPRI-AP-1429) Avail: NTIS HC A08/MF A01

An investigation of the effects on system thermal efficiency of major design variables and configuration options in combined cycle power plants based on air or oxygen-blown Texaco gasifiers is presented. The plants are sized to process 10,000 tons per day of Illinois No. 6 coal. Design parameters considered were: steam cycle steam conditions; gasification system pressure, oxidant temperature and composition; coal/water slurry ratio and temperature; ambient temperature; and fuel temperature. Configuration options considered were; the quantity of raw gas cooler by-pass flow; recirculation of cold gas to temper the raw gas product before entering the raw gas cooler; clean gas resaturation; use of a clean gas expander; plant size; use of steam turbines or electric motors for oxygen plant compressors; supplementary firing of the heat recovery steam generator. The system performance estimates and sensitivity studies were conducted for integrated gasification-combined cycle systems. DOE

N81-10199# Illinois Univ., Urbana. Dept. of Civil Engineering.

BIOLOGICAL CONVERSION OF BIOMASS TO METHANE Final Report, 1 Jun. 1976 - 31 Jan. 1980

J. T. Pfeffer Feb. 1980 143 p refs

(Contract EY-76-S-02-2917)

(COO-2918-16; UILU-eng-80-2009) Avail: NTIS HC A07/MF A01

An experimental methane fermentation system, constructed for the purpose of evaluating the processing requirements and conversion efficiencies associated with production of methane from various organic feed stocks is discussed. The fermentation reactors had an operating volume 0.775 cu m. This permitted operation with an approximate continuous feed of milled organics. A thermochemical pretreatment was applied to the corn stover and wheat straw in order to increase the biodegradability of these substrates. Kinetic data were obtained by operating four reactors at different retention times. These data were used to calculate a first order rate constant and the percent of substrate volatile solids that were biodegradable. Thermochemical pretreatment increased the biodegradability of stover volatile solids to 71 percent. The final substrate tested was a green crop that was field dried: alfalfa. Significant foaming problems were encountered with this material. The volatile solids were found to be 74 percent biodegradable at a fermentation temperature of 60 C. DOE

N81-10200# Battelle Columbus Labs., Ohio.

THERMOPHYSICAL PROPERTIES OF COAL LIQUIDS Quarterly Technical Status Report, 1 Apr. - 30 Jun. 1980

J. W. Droege, G. H. Stickford, and S. P. Cauhan 23 Jul. 1980 41 p refs

(Contract DE-AC01-79ET-14941)

(BMI-2063; QTSR-3) Avail: NTIS HC A03/MF A01

Certain physical properties, namely, viscosity, thermal conductivity, density, heat of reaction, and specific heat were determined as coal solvent slurries undergo dissolution reactions. Viscosity determinations on coal solvent slurries proceeded satisfactorily up to a temperature of about 570 K. At about that temperature in every case the bob stopped moving. Attempts to operate in this temperature range by more rapid bob movement, by using a more dilute slurry, and by substituting a more viscous solvent did not succeed in overcoming the difficulty, which seems to be related to the formation of a semisolid rather than to the separation of solids from the suspension. A transient line source technique was used for the measurement of thermal conductivity. Both platinum and tungsten wires were used to reproduce reference data for toluene. Measurements on the solvent were made at modest temperatures. Initial calorimetric measurements using a pressurized differential scanning calorimeter have yielded mixed results. DOE

N81-10201# Rockwell International Corp., Palo Alto, Calif. Energy Systems Group

MOLTEN ALKALI METAL HYDROXIDE CATALYZED COAL LIQUEFACTION Final Report, Oct. 1978 - Sep. 1979

R. P. Skowronski and L. A. Heredy Mar. 1980 124 p refs

(Contracts DE-AC01-78ET-13377; ET-78-C-01-3048)

(FE-3048-4) Avail: NTIS HC A06/MF A01

With a 2/1 NaOH melt/coal ratio, conversions of greater than 80 percent and liquid yields of greater than 50 percent can be achieved under hydroliquefaction conditions using tetralin. It is shown that NaOH is a more effective catalyst than KOH and NaOH affords very good heteroatom removal, particularly with respect to sulfur and nitrogen. At 400 C, some improvement in liquefaction is noted compared with the reaction at 425 C.

Contacting is very important. Preliminary experiments indicate impregnation of small amounts (2 wt %) of NaOH has some catalytic effect and improves conversion. Inconel 671 is a satisfactory material of construction for use with NaOH under hydroliquefaction conditions. Inconel 600, 617, 625, and 671 were tested as potential materials of construction for molten alkali metal hydroxide-catalyzed coal liquefaction. Coupons were tested in both the hydroxide-sulfide melt and in the vapor phase. The samples in the melt showed little evidence of corrosion, and the samples in the vapor phase showed even less. DOE

N81-10202# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).

ACTUAL AND PREDICTED RELIABILITY IN AEROSPACE PYROTECHNICS [FIABILITE PREVISIONNELLE ET EXPERIMENTALE EN PYROTECHNIE SPATIALE]

C. Lemay Paris 1979 7 p refs In FRENCH Presented at Congr. on Explosifs et Pyrotech.: Appl. Spatiales, Toulouse, 22-25 Oct. 1979

(SNIAS-792-422-104) Avail: NTIS HC A02/MF A01

The characteristics of pyrotechnic devices and the conditions under which they are used in space are presented. The theoretical approach to reliability analysis is outlined and the difficulties of using such analyses presented. Statistical applications of test results and the limits of their validity are mentioned.

Author (ESA)

N81-10203# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.

THE DOUBLE HELMHOLTZ RESONATOR AS A POSSIBLE TOOL FOR THE DETERMINATION OF THE RESPONSE FUNCTION OF SOLID ROCKET PROPELLANTS IN THE LOW FREQUENCY RANGE

H. F. R. Schoeyer Mar. 1980 51 p refs

(VTH-M-365) Avail: NTIS HC A04/MF A01

A theoretical analysis of a double Helmholtz resonator (HR) is presented. The laboratory utilization of a HR burner is recommended to measure the admittance function of propellants in a wide frequency range. The performance of a burner is analyzed and the quantities to be measured in order to deduct meaningful information about the propellant from test runs are indicated. The burner may use T-burner components. Its use with and without a surge tank is mentioned. Author (ESA)

N81-10204*# New England Research Application Center, Storrs, Conn.

ALUMINIZED PROPELLANTS AND EXPLOSIVES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Apr. 1980

Robert Hippler May 1980 73 p Sponsored by NASA and NTIS

(NASA-CR-163651; PB80-808561) Avail: NTIS HC $30.00/MF $30.00 CSCL 21I

A bibliography addressing the design, manufacture, and use of aluminized propellants and explosives is presented. Test data on the performance of these propellants and explosives are also given. Casting techniques, for insertion into the missile casing or other container, are described. The bibliography contains 57 citations. GRA

N81-10205# Office of Technology Assessment, Washington, D. C.

ALTERNATIVE ENERGY FUTURES. PART 1: BACKGROUND REPORTS. THE FUTURE OF LIQUEFIED NATURAL GAS IMPORTS

Mar. 1980 435 p refs

(PB80-203847) Avail: NTIS HC A19/MF A01 CSCL 21E

Future demand for gas, implications for liquefied natural gas policy; North American oil and gas resources and production potential are analyzed. Imported liquefied natural gas projects, supply and consumption are discussed. GRA

N81-10206*# New England Research Application Center, Storrs, Conn.

ALUMINIZED PROPELLANTS AND EXPLOSIVES. CITATIONS FROM THE INTERNATIONAL AEROSPACE DATA BASE Progress Report, 1964 - Apr. 1980

Robert Hippler May 1980 16 p Sponsored by NASA and NTIS

(NASA-CR-163674; PB80-808579) Avail: NTIS HC $30.00/MF $30.00 CSCL 21I

The design, manufacture, and use of aluminized propellants and explosives are the subject of the 8 cited abstracts. Test data on the performance of these propellants and explosives are also given. Casting techniques, for insertion into the missile casing or other container, are described. GRA

N81-10207# Wisconsin Univ., Madison. Dept. of Bacteriology.

BIOLOGICAL SYSTEMS FOR LIGNOCELLULOSE CONVERSION Progress Report, 1 Aug. 1979 - 31 Jan. 1980

J. G. Zeikus and T. K. Kirk 1980 111 p Prepared in cooperation with Forest Products Lab., Madison, Wisc.

(Grants NSF AER-75-22789; NSF PFR-79-10084)

(PB80-196751; NSF/RA-800061; PR-7) Avail: NTIS HC A06/MF A01 CSCL 06A

Microbiological approaches to the utilization of lignocellulosic biomass are reported. Lignin metabolism by P. chrysosporium and of cellulose metabolism by C. thermocellum were studied. Specific tasks in the studies of lignin metabolism included (1) determining amino acid pools and total protein in cultures of P. chrysosporium on the cultures shift from preligninolytic to ligninolytic (primary to secondary metabolic); (2) comparing the kinetics of suppression of ligninolytic activity by nitrogenous compounds with that caused by the protein synthesis inhibitor cycloheximide, in ligninolytic cultures of P. chrysosporium; and (3) attempting to trigger early appearance of ligninolytic activity in cultures of P. chrysosporium using proteases or protease inducers, thereby evaluating the possibility that proteases provide the connection between the onset of lignin degradation and nitrogen starvation. GRA

N81-10208# Petroleum Conservation Research Association, New Delhi (India).

USE OF ETHANOL FROM SUGAR MOLASSES AS A BLENDING COMPONENT IN GASOLINE

1979 20 p

(PB80-197874) Avail: NTIS HC A02/MF A01 CSCL 21E

The possibilities and the various issues involved in the use of ethyl alcohol from sugar molasses as a blend component in gasoline in India are analyzed. GRA

N81-10209# Economics, Statistics and Cooperatives Service, Washington, D. C. National Economics Div.

GASOHOL: PROSPECTS AND IMPLICATIONS

Ronald Meekhof, Mohinder Gill, and Wallace Tyner Jun. 1980 36 p refs

(PB80-202112; AER-458) Avail: NTIS HC A03/MF A01 CSCL 21D

Current and proposed legislation, current and near-term ethanol production capacity, the economics of ethanol production, and its impact on the balance of trade and the farm sector are examined. GRA

N81-10210# Columbia Univ., New York. Dept. of Biochemistry.

BIOLOGICAL AND SYNTHETIC SYSTEMS FOR PRODUCTION OF HYDROGEN FROM WATER Final Report, 1 Jun. 1975 - 31 Mar. 1980

Alvin I. Krasna Mar. 1980 20 p refs

(Grant NSF PFR-74-08381)

(PB80-200942; NSF/RA-800064) Avail: NTIS HC A02/MF A01 CSCL 06A

The laboratory feasibility of producing hydrogen by biophotolysis of water is demonstrated. One method uses intact hydrogenase-containing algae capable of yielding large quantities of hydrogen in the presence of oxygen removing agents. Another biophotolysis scheme uses isolated plant chloroplasts coupled to hydrogenase or synthetic catalysts, with ferredoxin or methyl viologen as an electron carrier. Light acts on water to produce hydrogen in the presence of oxygen removing systems. The anerobic reduction of the electron carrier by chloroplasts is the limiting factor in the process. Platinum and palladium catalysts can effectively replace hydrogenase in this coupled system. These methods constitute a nonpolluting, alternate technology to produce

hydrogen for fuel and as a chemical feedstock for fertilizer production. GRA

N81-10225# Joint Publications Research Service, Arlington, Va.

BIOGAS AS ENERGY SOURCE EXAMINED

Rudolf Wicha *In its* West Europe Rept.: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 9-11 Transl. into ENGLISH from Unser Umwelt (Vienna), no. 32, 1979 p 6-7 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

N81-10999# Joint Publications Research Service, Arlington, Va.

STATES CONSIDER NEW COAL-BURNING TECHNOLOGIES

In its West Europe Rept.: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 58-61 Transl. into ENGLISH from Energie (Graefelfing, West Germany), Jul. 1979 p 228-229 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-10211# National Oceanic and Atmospheric Administration, Rockville, Md. Office of Ocean Engineering.

REMOTELY OPERATED VEHICLES, AN OVERVIEW

Joseph R. Vadus and R. Frank Busby Dec. 1979 24 p Prepared in cooperation with Busby (R. Frank) Associates, Arlington, Va. (PB80-201353; NOAA-80052902; NOAA-TR-OOE-6) Avail: NTIS HC A02/MF A01 CSCL 13J

Four types of remotely operated vehicles are identified. The growth, application and utilization of the more than 180 vehicles constructed and under development is discussed. Current operational problems vary, but cable entanglement and system reliability are the dominant technical liabilities. Current development trends are aimed at specialized vehicles and equipment for support of offshore oil and gas exploration, development and production. The advent of low-cost, simplified ROV's has placed this technology in the hands of virtually any activity involved in utilization and investigation of the marine environment. Vehicles developed by worldwide organizations are identified. GRA

N81-10212# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.

FREQUENCY DOMAIN IDENTIFICATION OF STRUCTURAL MODELS FROM EARTHQUAKE RECORDS Ph.D. Thesis

Graeme Haynes McVerry Oct. 1979 224 p refs
(Grant NSF PFR-77-23687)
(PB80-194301; NSF/RA-790437) Avail: NTIS HC A10/MF A01 CSCL 13M

The usefulness of simple linear mathematical models for representing the behavior of tall buildings during earthquake response is investigated for a variety of structures over a range of motions including models which best reproduce the measured response of the structures are determined from the recorded earthquake motions. A method is developed to identify a single linear model appropriate for the entire response. The study investigated earthquake records obtained from ten structures ranging in height from seven to forty two stories. Very small amplitudes response were reproduced well by linear models with fundamental periods similar to those measured in vibration tests. GRA

N81-10213# Virginia Highway Research Council, Charlottesville.

VARIATIONS IN SKID RESISTANCE OVER TIME, PART 1 Final Report

Stephen N. Runkle and David C. Mahone Feb. 1980 58 p Sponsored in part by Virginia Dept. of Highways and Transportation, Richmond
(PB80-198807; FHWA/VA-80/33; VHTRC-80-R33) Avail: NTIS HC A04/MF A01 CSCL 13B

The Virginia Department of Highways and Transportation survey skid trailer, the Department's research trailer, the research stopping distance car, and the grease patch method of measuring surface texture were evaluated with respect to time and weather dependent changes in measured values. The grease patch method of measuring texture seems to have the same basic relationship to weather variables as does the Department's survey trailer, but the relationship is consistent among sites. Also, the use of this method is time consuming and expensive. The research trailer experienced so many breakdowns that the researchers place little confidence in the results obtained with this testing device. For the stopping distance car it was found that the average standard deviation for all test speeds on the six sites tested was 3.26 skid numbers. GRA

N81-10214# Minnesota Dept. of Transportation, St. Paul. Materials Office.

USE OF LUG ANCHORS TO RELATED PAVEMENT MOVEMENT Final Report

Stephan A. Oakey Apr. 1980 18 p
(PB80-197734; FHWA/MN-80/1) Avail: NTIS HC A02/MF A01 CSCL 13B

Minnesota Department of Transporatation's policy is that grades in the 3 to 5 percent and greater range are steep and may require lug anchors. Standard lug anchor spacing varies from 150 feet, center to center, for 3 percent grades to 75 feet, center to center, for 5 percent and greater grades. Conclusions are: (1) that lug anchors do prevent the downhill movement of the concrete pavement; (2) that when lug anchors are used a perforated pipe system also be built to collect the surface water that enters the pavement structure thus eliminating the anticipated base pumping and pavement settlement. GRA

N81-10215# National Business Aircraft Association, Inc., Washington, D. C. National Measurement Lab.

NATIONAL MEASUREMENT LABORATORY, TECHNICAL HIGHLIGHTS

John D. Hoffman 1979 122 p refs
(PB80-199938; NBS-SP-572) Avail: NTIS HC A06/MF A01 CSCL 07D

Selected highlights of research and other technical activities in the National Measurement Laboratory of the National Bureau of Standards during calendar year 1979 are given. Comprehensive overviews provide the introductions to the activities in the five centers and seven programs of the Laboratory. Listings of the Professional staff in each of these units are also provided. GRA

N81-10216# Transportation Research Board, Washington, D.C.

PERFORMANCE OF PAVEMENTS DESIGNED WITH LOW-COST MATERIALS

Robert W. Grau, W. A. Yrjanson, R. G. Packard, Richard D. Barksdale, Charles F. Potts, Byron E. Ruth, Lawrence L. Smith, Ira J. Huddleston, Ted S. Vinson, R. G. Hicks et al 1980 58 p refs
(PB80-205628; TRB/TRR-741; ISBN-0-309-02999-6; LC-80-17917) Avail: NTIS HC A04/MF A01; Paper copy also available from Transportation Research Board, 2101 Constitution Ave. NW, Washington, D.C. 20418 CSCL 13C

The following areas are discussed. Utilization of marginal aggregate materials for secondary road surface layers; econocrete pavements; current practices; construction and performance of sand-asphalt bases and performance of sand-asphalt and limerock pavements in Florida. Cement stabilization of degrading aggregates use of crushed stone screenings in highway construction (abridgement); and sulfur-asphalt pavement technology are also reviewed. GRA

N81-10217# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

SOIL WATER PROPERTIES OF SUBGRADE SOILS Final Report, 1 Jul. 1977 - 31 Dec. 1979

Donald J. Janssen and Barry J. Dempsey Apr. 1980 219 p refs
(PB80-201478; FHWA/IL/UI-184; UILU-eng-80-2010; Rept-27) Avail: NTIS HC A10/MF A01 CSCL 13B

The soil water characteristic data and hydraulic conductivity data were determined for 24 soil series in Illinois. Laboratory testing procedures for determining the saturated hydraulic conductivity and soil water characteristic data were described in

detail. Matric suction was determined by use of Tempe pressure cells at low pressure and a pressure plate apparatus at the higher pressures. The influence of soil type on matric suction and hydraulic conductivity was discussed. It was shown that subgrade soil strength can be predicted based on knowledge of the equilibrium water content determined from the soil water characteristic relationship and field boundary conditions. GRA

N81-10218# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.
PERFORMANCE OF PREFORMED COMPRESSION SEALERS IN TRANSVERSE PAVEMENT JOINTS Final Report
James E. Bryden and Ronald A. Lorini Mar. 1980 48 p refs (PB80-201320: FHWA/NY-80/RR-76) Avail: NTIS HC A03/MF A01 CSCL 13B

Preformed compression sealers, 1-1/4 in. wide and installed in 5/8 in. wide transverse contraction joints in rigid pavements, were observed for up to 10 years. Many joints closed tighter than the 5/8 in. minimum design width. Results of force deflection and recovery tests performed on new sealer samples related to compression set occurring during field service, but not to infiltration. Force deflection and recovery properties of the sealers generally decreased after field aging. Preconditioning sealer samples at elevated (212 F) or reduced (14 and 20 F) temperatures produced changes in force deflection and recovery properties. A laboratory cycle test, which simulates joint infiltration, appeared to relate to field infiltration. GRA

N81-10219# Joint Publications Research Service, Arlington, Va. Foreign Broadcast Information Service.
WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY, NO. 13
30 Jan. 1980 49 p refs Transl. into ENGLISH from various European journals
(JPRS-75031) Avail: NTIS HC A03/MF A01

Information on technology strategies and research and development programs in Western Europe is presented. Particular attention is given to power cable insulation and solar power applications. For individual titles, see N81-10220 through N81-10222.

N81-10220# Joint Publications Research Service, Arlington, Va.
ADVANTAGES, PRACTICAL USES OF WATER-INSULATED CABLE c33
In its West Europe Rept.: Sci. and Technol., No. 13 (JPRS-75031) 30 Jan. 1980 p 1-11 Transl. into ENGLISH from Energie (Graefelfing, West Germany), no. 10, Oct. 1979 p 334-337 (For primary document see N81-10219 01-31)
Avail: NTIS HC A03/MF A01

The technology associated with the development of a power cable that is internally cooled by water is described. Some of the economic and technical advantages of the use of this cable over other, more conventional, cables are discussed. R.C.T.

N81-10221# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT, MANUFACTURE OF GAS-INSULATED CABLE c33
Eng Eckhard Abilgaard *In its* West Europe Rept.: Sci. and Technol., No. 13 (JPRS-75031) 30 Jan. 1980 p 12-31 refs Transl. into ENGLISH from Energie (Graefelfing, West Germany), no. 10, Oct. 1979 p 328-333 (For primary document see N81-10219 01-31)
Avail: NTIS HC A03/MF A01

The development of a flexible, SF6 insulated tubular gas cable is described. It is shown that the transmission power of the cable increased because the SF6 gas reduces electrical losses and also promotes heat dissipation. R.C.T.

N81-10222# Joint Publications Research Service, Arlington, Va.
DESALINATION OF WATER WITH SOLAR POWER c44
B. Agricola and V. Cena *In its* West Europe Rept.: Sci. and Technol., No. 13 (JPRS-75031) 30 Jan. 1980 p 32-44 Transl. into ENGLISH from Fonti di Energia Alternative (Rome), no. 2, Mar. - Apr. 1979 p 22-27 (For primary document see N81-10219 01-31)
Avail: NTIS HC A03/MF A01

A critical analysis of the state of the art of solar desalinization is presented. The technical and economic viability of the process is assessed and the predictable evolution of certain parameters of interest is evaluated. The developmental lines of research objectives that are attainable in the short and medium terms from the standpoint of their industrial realization are also discussed. T.C.T.

N81-10223# Joint Publications Research Service, Arlington, Va.
WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY NO. 3
14 Nov. 1979 85 p Transl. into ENGLISH from various European articles
(JPRS-74565) Avail: NTIS HC A05/MF A01

Information on national level science policies, technology strategies, and research and development programs in West European science and technology in general and specifically in civil technology is presented. Particular attention is given to transportation, energy, chemical manufacturing, industrial automation and technology transfer. For individual titles, see N81-10224 through N81-10229.

N81-10224# Joint Publications Research Service, Arlington, Va.
EEC RESEARCHERS TEST ALTERNATIVE ENERGY TECHNOLOGIES c44
In its West Europe Rept.: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 1-6 Transl. into ENGLISH from Wirtschaftswoche (West Germany), no. 38, 17 Sep. 1979 p 46-52 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

An overview of the energy situation in the European community and the efforts directed towards the development of alternative energy technologies is given. Solar thermal conversion, photovoltaics, hydrogen production, and biomass conversion prospects are examined in terms of their technological and economical feasibility. M.G.

N81-10225# Joint Publications Research Service, Arlington, Va.
BIOGAS AS ENERGY SOURCE EXAMINED c28
Rudolf Wicha *In its* West Europe Rept.: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 9-11 Transl. into ENGLISH from Unser Umwelt (Vienna), no. 32, 1979 p 6-7 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

The generation of biogas from animal manure is discussed. The manure can be fermented in fermentation containers at a mesophile temperature of 35 C and an average duration of 30 days. The biogas formed is collected in a gas container, from whence it is conducted to the areas of utilization. The subsequent energy transformation can proceed by means of conventional gas burners for heat generation in hot water heating facilities or for electrical current generation in a gas motor generator aggregate. The long duration (approximately 30 days) until gas formation can be shortened by appropriate measures. A total of 70 percent of the biogas is methane; the carbon dioxide content depends on the temperature of the decomposition process and decreases in proportion to the temperature. The heating value lies at 24,700 kj (5,900 kcal/cum) and can be increased by rinsing out the carbon dioxide to approximately 37,680 kj (9,000 kcal/cum). Such biogas facilities become economically feasible with at least 20 GVE's (1 GVE = 500 kg of live weight). This amounts to 20 cows or 200 hogs or 3,500 hens. M.G.

N81-10226# Joint Publications Research Service, Arlington, Va.
IMPROVED USE, REUSE OF SPENT OIL PROPOSED c44
In its West Europe Rept.: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 12-15 Transl. into ENGLISH from Unsere Umwelt (Vienna), no. 32, 1979 p 23-24 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

The possibilities of reuse for several typical types of mineral oil waste are illustrated with particular reference to their economic feasibility. The utilization of spent oil as an energy

source in enterprises with and without specifically designed spent oil burners is examined; environmental considerations are addressed. The refining of spent oil and its reuse as a lubricant are also considered. M.G.

N81-10227# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF NEW VEHICLE ENGINE REPORTED **c37**
In its West Europe Rept.: Sci. and Technol.,No. 3 (JPRS-74565) 14 Nov. 1979 p 16-17 Transl. into ENGLISH from Unsere Umwelt (Vienna), no. 32, 1979 p 28 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

The development of a combustion method with direct fuel injection for the diesel engine, which will both reduce fuel consumption by 15 to 20 percent and reduce the burden on the environment is briefly described. A model of a 2 liter prototype engine with four cylinders and direct fuel injection with 46 horsepower was produced. The development costs for the engine are given. M.G.

N81-10228# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF MULTILAYER CONDUCTORS DISCUSSED **c33**
C. Val *In its* West Europe Rept.: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 40-62 refs Transl. into ENGLISH from Rev. Tech. Thomson-CSF (France), no. 2, Jan. 1979 p 259-260 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

The qualification testing of multilayered devices using copper conductors is discussed. The advantages of utilizing copper as opposed to gold are determined. Copper is particularly well suited to the process involving the use of tin, for it exhibits brazability and reliability with respect to Sn-Pb alloys far superior to those obtained with gold and gold alloys. The solderability of the 60Sn/40Pb alloy makes it possible on one hand to obtain metallurgically stable bonds, and on the other, avoids the reliability problems encountered with multilayers based on gold or gold-platinum, which are primarily due to the formation of Au/Sn and Au/In intermetallic compounds in the case of solders based on indium. Moreover, the theoretical resistivity of gold is 40% higher than that of copper. The dielectric constants of insulating layers are slightly lower than those achieved by dielectrics baked in air. This reduces propagation times and improves the electrical performance of systems. M.G.

N81-10229# Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS, EFFICIENCY OF MODULAR ENGINES **c37**
In its West Europe Rept: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 63-79 refs Transl. into ENGLISH from Ata (Italy), no. 4, Apr. 1979 p 177-184 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

Tests aimed at quantifying the fuel savings to be achieved with automobile engines adopting different techniques for deactivating the cylinders (reduction of displacement, reduction of fuel mixture flow, reduction of fuel) are discussed. The reduction of the displacement amounts to disconnecting the shaft linkage of the modules deactivated. Reduction of fuel mixture flow consists in preventing fuel mixture cycling in the deactivated cylinders by keeping the relative intake and exhaust valves closed. With fuel reduction, modest results are accompanied by considerable constructional simplicity, without appreciable added costs for engines equipped with electronic ignition. Reduction of fuel mixture flow permits greater savings, so that it appears quite promising for short term realization, inasmuch as it does not require redesign of the entire engine. Far superior are the benefits offered by displacement reduction. The necessity of radical redesign for such an engine, together with the time needed for developing and testing the intermodular coupling, puts the application possibilities some time into the future. M.G.

N81-10498# Joint Publications Research Service, Arlington, Va.
MINISTER OFFICIALS DISCUSS METROLOGY POLICY
In its West Europe Rept.: Sci. and Technol.,No. 14 (JPRS-75070) 5 Feb. 1980 p 3-7 Transl. into ENGLISH from AFP Sci. (France), 20 Dec. 1979 p 2-6 (For primary document see N81-10497 01-42)
Avail: NTIS HC A04/MF A01

N81-10996# Joint Publications Research Service, Arlington, Va.
COMPUTER-CONTROLLED MANUFACTURING
In its West Europe Rept.: Sci. and Technol.,No. 5 (JPRS-74642) 27 Nov. 1979 p 32-40 Transl. into ENGLISH from Handelsblatt (Duesseldorf), 8 Oct. 1979 p 192-195 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-10230 Texas Univ. at Arlington.
DIFFERENTIAL PULSE CODE MODULATION WITH ADAPTIVE PREDICTION FOR COMPOSITE COLOR TELEVISION SIGNALS Ph.D. Thesis
Venkatachalam Devarajan 1980 147 p
Avail: Univ. Microfilms Order No. 8022981

Adaptive differential pulse code modulation coders with adaptive prediction are proposed and compared with existing nonadaptive coders for processing composite television signals. Comparisons are based on quantitative criteria as well as subjective evaluation of the processed still frames. The performance of the proposed predictors is shown to be independent of well designed quantizers and better than existing predictors in such critical regions of the pictures as edges and contours. The channel error propagation characteristics of the new coders are investigated. Combination predictors are proposed and are shown to reduce the propagation of channel errors significantly without compromising the redundancy reducing performance of the predictors.
Dissert. Abstr.

N81-10231# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
IMPACT OF SATELLITE POWER SYSTEM (SPS) HEATING ON VLF, LF, AND MF TELECOMMUNICATIONS SYSTEMS ASCERTAINED BY EXPERIMENTAL MEANS
C. M. Rush, E. J. Violette, R. H. Espeland, J. C. Carroll, and K. C. Allen Apr. 1980 105 p refs
(PB80-194459; NTIA-R-80-37) Avail: NTIS HC A06/MF A01

Using the high-power high-frequency transmitter facility loacated at Platteville, Colorado, power densities comparable to the Satellite Power System (SPS) can be delivered to the heights of 70 to 100 km above the surface of the earth. Observations of the performance of telecommunication systems that operate in the VLF, LF, and MF portions of the spectrum were investigated during times when the ionosphere was modified with SPS comparable power density and when it was not. The results obtained indicate that the SPS, as currently configured with a peak power density of 23 mW/sq cm, will not adversely impact upon the performance of VLF, LF, and MF telecommunicaiton systems. GRA

N81-10232 Southern Methodist Univ., Dallas, Tex.
STATISTICAL ANALYSIS OF ZERO-CROSSING SAMPLING DIGITAL FADING PHASE-LOCKED LOOPS Ph.D. Thesis
Suryanarayana Venkata Varanasi 1980 137 p
Avail: Univ. Microfilms Order No. 8025540

Statistical analysis of zero crossing sampling first and second order digital fading phase locked loops is presented. The zero crossing phase detector employed in the DFPLL structure samples the incoming signal on the positive zero crossings and tracks the phase of the incoming signal. The incoming signal is not

only corrupted by an additive Gaussian noise (AGN) channel but also by a fading channel. Analyzing zero crossing digital phase locked loops considering that the signal is solely contaminated by an AGN channel is inadequate in most of the deep space communications applications in which the signal invariably undergoes fading due to many physical phenomena for example: solar, planetary atmospheres, turbulent media, etc., The equations describing the first and second order DFPLL operation in terms of the phase error process are nonlinear stochastic difference equations with random coefficients. Dissert. Abstr.

N81-10233 Connecticut Univ., Storrs.
ELASTIC WAVE PROPAGATION IN INHOMOGENEOUS LOSSY MEDIA WITH SPECIAL REFERENCE TO POWDERS Ph.D. Thesis
Geoffrey Roy Akers 1980 152 p
Avail: Univ. Microfilms Order No. 8025338

A vector wave equation is developed for an anisotropic, inhomogeneous lossy medium with a set of effective Lame constants derived from microscopic considerations of the medium. A composite loss function, L, to account for the energy loss mechanisms that occur as the wave propagates is developed. The displacement fields are examined over the frequency regime in the near and far field for the waves. The effective Lame parameters are included in the solution, and their contribution, as well as the frequency contribution to the wave field is seen. Higher orders of scattering and diffraction are seen as well as the anharmonicites and nonlinear effects of losses. These effects may be observed in the general wavefield description. Also the effect of losses on the dispersion behavior is observed as a frequency shift of the wave. The specific losses for an inhomogeneous granular medium (powder) surrounded by fluid (liquid/gas/or vacuum) are developed and ordered in magnitude over the frequency spectrum. Solution for the granular powder is obtained. Dissert. Abstr.

N81-10234 New Mexico Univ., Albuquerque.
REAL-TIME MULTI-INTENSITY IMAGE RECONSTRUCTION FROM PROJECTIONS FOR MULTI-PROCESSOR Ph.D. Thesis
Anthony K. Stevens 1980 107 p
Avail: Univ. Microfilms Order No. 8024836

The use of microprocessors to perform video data analysis is discussed. The application of projections in data analysis represents a significant data reduction while contributing to improved tracking algorithms and the enhancement of image identification. A mathematical analysis of the ambiguity of multi-intensity pictures (digitized video) with respect to their projections is presented. Two unique classes are defined that are general enough to represent a large class of digitized video pictures. The two classes are the band class and the bar class. A detailed description with proofs of uniqueness are given for each class. They are the basic building blocks for the reconstruction of ambiguous pictures. Since it is desired to reconstruct a picture using its projections in realtime, only fast reconstruction approximations are investigated. Four methods that accomplish fast reconstructions are presented in this dissertation. All four methods depend on block reconstruction techniques. Simulation results of all methods are presented. Dissert. Abstr.

N81-10235 Pennsylvania State Univ., University Park.
AN EXPERIMENTAL ANALYSIS OF THE BASIC PHENOMENA INVOLVED IN MODERN DIFFRACTION THEORIES Ph.D. Thesis
Mark Stiles Lang 1980 452 p
Avail: Univ. Microfilms Order No. 8024465

Direct experimental techniques are utilized to analyze the basic scattering mechanisms important to modern diffraction theories. The efforts are intended to supplement and guide the development of theoretical models by exploring parameter ranges and configurations that are intuitive extensions of the cases handled by current prediction techniques. A broad program of experimental investigation of rigid three dimensional scatterers is presented. The results show that the back-scattered pressure from smoothly curved bodies is determined almost exclusively by specular effects, even at wavelengths that are relatively large compared to the appropriate dimensions of the scatterers. However, small changes in, or additions to the smooth surface, modify both the amplitude and directivity of the scattering. The Freedman theory of echo formation is derived and its predictions are compared with applicable experimental results. The technique is found to be an exact variant of physical optics that produces a reasonably good model of scattering from baffles but that exhibits serious errors in cases involving three dimensional bodies. Dissert. Abstr.

N81-10236 Kansas Univ., Lawrence.
RADAR BACKSCATTER STUDY OF SEA ICE Ph.D. Thesis
Robert Gary Onstott 1980 272 p
Avail: Univ. Microfilms Order No. 8026726

The ability to use radar backscatter measurements to discriminate ice types was investigated. The 1-2 GHz measurements showed that thick first year and multiyear sea ice cannot be distinguished at 10 deg = 70 deg incidence angles, but that undeformed sea ice can be discriminated from pressure ridged thick first year sea ice and lake ice. Frequencies between 8-18 GHz have the ability to discriminate between thick first year sea ice, multiyear sea ice, and lake ice. The lowest frequency, 9 GHz, was found to provide the greatest separation between these ice categories with significant levels of separation existing between angles of incidence from 15 deg to 70 deg. An empirical model was developed which describes the angular and frequency variations for thick first year sea ice, multiyear sea ice, and lake ice. The standard deviation of the model and the average scattering cross section was at worst 2 dB. Dissert. Abstr.

N81-10237 North Carolina State Univ. at Raleigh.
ON THE PROBLEMS OF ENCODING VIDEO INFORMATION Ph.D. Thesis
Isaac Jacob Dukhovich 1980 244 p
Avail: Univ. Microfilms Order No. 8020525

The topics include: (1) some properties of correlation functions of random fields which are commonly used for image representation; (2) class of rate distortion functions for a one, two and three dimensional image source; (3) composite model of a three dimensional moving image; (4) a generalized, fully adaptive (nonlinear) DPCM encoder decoder system, its analysis, and optimization procedures; and (5) computer simulation of some type of nonlinear predictors which can be used in DPCM systems. Dissert. Abstr.

N81-10238*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PILOT SIGNALS FOR LARGE ACTIVE RETRO-DIRECTIVE ARRAYS
C. H. Chan Aug. 1980 19 p refs
(NASA-TM-78310) Avail: NTIS HC A02/MF A01 CSCL 17B

It has been suggested that for large active retrodirective arrays, as in the solar power system, a two tone uplink pilot signal with frequencies symmetrically situated around the downlink frequency be used in order to reduce ionospheric biases and to lower the cost since a two tone receiver is economically much cheaper than a single tone phase locked receiver. Such a system now faces two difficulties: the Pi-ambiguity; and a large phase difference between the downlink and uplink signals. The Pi-ambiguity is shown to be easily removed by using a two tone uplink signal with both frequencies situated at one side of the downlink frequency, and the phase difference can be greatly reduced with a three tone or a four tone uplink pilot signal.
R.K.G.

N81-10239*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ECONOMICS SYSTEMS ANALYSIS OF LAND MOBILE RADIO TELEPHONE SERVICES
B. E. Leroy and S. M. Stevenson 13 Nov. 1980 15 p refs Presented at INTELCOM 80/Los Angeles Conf., Los Angeles, 10-13 Nov. 1980
(NASA-TM-81476; E-589) Avail: NTIS HC A02/MF A01 CSCL 17B

The economic interaction of the terrestrial and satellite systems is considered. Parametric equations are formulated to allow examination of necessary user thresholds and growth rates as a function of system costs. Conversely, first order allowable systems costs are found as a function of user thresholds and

growth rates. Transitions between satellite and terrestrial service systems are examined. User growth rate density (user/year/sq km) is shown to be a key parameter in the analysis of systems compatibility. The concept of system design matching the price/demand curves is introduced and examples are given. The role of satellite systems is critically examined and the economic conditions necessary for the introduction of satellite service are identified. Author

N81-10240*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF INTERMODULATION EFFECTS AND RELATED EFFICIENCIES ASSOCIATED WITH TWO- AND THREE-SIGNAL OPERATION OF A TRAVELING WAVE TUBE

Thomas A. Fox Oct. 1980 30 p refs

(NASA-TM-81576; E-546) Avail: NTIS HC A03/MF A01 CSCL 17B

An experimental investigation of multiple signal operations using an octave bandwidth traveling wave tube (TWT) was conducted in order to approximate the behavior of a TWT being developed for multichannel digital communication. Test results include the intermodulation effects as well as collector and overall efficiencies associated with two and three discrete signal operations. Data are presented for operations that cover approximately a 4 dB range in combined signal output power up to the maximum RF power achievable in each case. (For multiple signal operation the term maximum power is more appropriate than saturation). The power associated with intermodulation products was very small at operating levels 4 dB below maximum power, but it approached 15 percent of the total combined output at maximum power for the two signal case and 20 percent for the three signal case. The maximum RF output powers in the multiple signal cases were 20 to 25 percent lower than the saturated output level for any of the signals inserted individually. In general, both the collector (a five stage depressed collector was used) and overall tube efficiencies were adversely affected during multiple signal operation in a manner related to the power levels involved. At 4 dB below maximum, where the intermodulation effects were small, it was possible to achieve collector and overall efficiencies with multiple signals that are comparable to single signal efficiencies. This changed gradually until at maximum RF output the collector efficiencies were several percentage points less and the overall efficiency as much as 10 percentage points less (a change of 25 percent) than single frequency values. The large overall efficiency loss is partially due to the loss in collector efficiency but largely due to the loss in usable RF power that is associated with the intermodulation power. The three signal tests were always the more severely affected. Author

N81-10241*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SATELLITES USING THE 30/20 GHz BAND

Joseph N. Sivo 1980 16 p To be presented at the 1980 Natl. Telecommunications Conf., Houston, Texas, 30 Nov. - 4 Dec.; Sponsored by IEEE

(NASA-TM-81600; E-586) Avail: NTIS HC A02/MF A01 CSCL 17B

A review of the future options open to satellite system planners focuses attention on the use of the 30/20 GHz band. Very broad bandwidths available, coupled with a primary allocation for fixed satellite service, make the band very attractive. NASA, in concert with the system and service supplier industries, is planning a research and development program aimed at flight demonstration of 30/20 satellite systems which it is hoped will lead to operational system use in the early 1990's. The communication system concepts and the spacecraft systems necessary to support these for operational use in 1990 and beyond are discussed. Author

N81-10242*# Mitre Corp., Bedford, Mass.

SECOND YEAR TECHNICAL REPORT ON-BOARD PROCESSING FOR FUTURE SATELLITE COMMUNICATIONS SYSTEMS

William T. Brandon, Warren K. Green, Murray Hoffman, Paul N. Jean, William R. Neal, and Brian E. White Oct. 1980 255 p refs

(Contract F19628-80-C-0001)

(NASA-CR-165155; MTR-8164; TR-2) Avail: NTIS HC A10/MF A01 CSCL 17B

Advanced baseband and microwave switching techniques for large domestic communications satellites operating in the 30/20 GHz frequency bands are discussed. The nominal baseband processor throughput is one million packets per second (1.6 Gb/s) from one thousand T1 carrier rate customer premises terminals. A frequency reuse factor of sixteen is assumed by using 16 spot antenna beams with the same 100 MHz bandwidth per beam and a modulation with a one b/s per Hz bandwidth efficiency. Eight of the beams are fixed on major metropolitan areas and eight are scanning beams which periodically cover the remainder of the U.S. under dynamic control. User signals are regenerated (demodulated/remodulated) and message packages are reformatted on board. Frequency division multiple access and time division multiplex are employed on the uplinks and downlinks, respectively, for terminals within the coverage area and dwell interval of a scanning beam. Link establishment and packet routing protocols are defined. Also described is a detailed design of a separate 100 x 100 microwave switch capable of handling nonregenerated signals occupying the remaining 2.4 GHz bandwidth with 60 dB of isolation, at an estimated weight and power consumption of approximately 400 kg and 100 W, respectively. M.G.

N81-10243# Communications Satellite Corp., Clarksburg, Md.

COMSAT PARTICIPATION IN ARPA PACKET SATELLITE PROGRAM PSP Final Report, 1 Jun. 1978 - 1 Sep. 1979

L. C. Palmer, D. Mills, and S. Rothschild Oct. 1979 292 p refs

(Contract F04701-76-C-0240; ARPA Order 3287)

(AD-A089224; TSLAP-79-2; SD-TR-80-32) Avail: NTIS HC A13/MF A01

This final report summarizes the last year of the Communication Satellite Corporation's (COMSAT's) participation in the Atlantic Packet Satellite Program (SATNET), an experimental program involving packet data transmission via a single 64 Kb/s SCPC channel in the SPADE Transponder of INTELSAT via (Atlantic Primary) between standard A Earth stations at Etam, W.Va., Goonhilly, U.K., and Tanum, Sweden. A fourth, smaller (G/T = 28.5 dB/K) Earth station at COMSAT Laboratories, Clarksburg, Md. also participated in the experimental network. The report describes new packet satellite program (PSP) terminals which were fabricated at COMSAT Laboratories for installation at the large INTELSAT Earth stations. These terminals contain the necessary interfaces and modems to interconnect the SIMP (Satellite Interface Message Processor) and the Earth station intermediate frequency (i.f.) equipment. Also described is the command and monitoring (C M) module which is a part of the PSP terminal. Channel monitoring data collected during 1979 are summarized. Preliminary tradeoff results comparing packet satellite transmission to other alternatives are also included in the report. GRA

N81-10244# Motorola, Inc., Scottsdale, Ariz. Government Products Div.

SAW PROGRAMMABLE MATCHED FILTER SIGNAL PROCESSOR Final Technical Report, 22 Sep. 1978 - 22 Jan. 1980

Fred Hickernell Wright-Patterson AFB, Ohio RADC Jun. 1980 65 p refs

(Contract F30602-78-C-0209; AF Proj. 4519)

(AD-A089199; RADC-TR-80-199) Avail: NTIS HC A04/MF A01 CSCL 09/5

A monolithic surface wave programmable matched filter signal processor operating at 100 MHz was designed, fabricated and evaluated. The semiconductor and acoustic elements were developed on (001) n-type silicon oriented for acoustic transmission along the (100) direction. Surface acoustic waves at 100 MHz were generated by a zinc oxide film layer transducer into an array of 31 silicon gate NMOS piezoresistive FET taps spaced at 10 ns intervals. The drain lines of all taps were connected to serve as the rf output. The phase and amplitude of each tap was controlled by a digital shift register and analog voltage to the tap gates. The die size for a single 31 bit filter was 0.980 inch by 0.120 inch. This development represented a significant step toward the realization of a compact, low cost, highly versatile matched filter device for signal processing applications in

communications equipment. Specific problem areas were solved. A quantitative assessment of various aspects of ZnO/Si MOSFET technology was made and the viability of the monolithic integration of SAW and semiconductor circuitry on silicon was demonstrated. GRA

N81-10245# RAND Corp., Santa Monica, Calif.
NETWORK STRUCTURES FOR DISTRIBUTED SITUATION ASSESSMENT Interim Report
R. Wesson, Frederick Hayes-Roth, J. Burge, C. Stasz, and C. Sunshine Aug. 1980 49 p refs
(Contract MDA903-78-C-0029; ARPA Order 3460)
(AD-A089386; RAND/R-2560-ARPA) Avail: NTIS HC A03/MF A01 CSCL 15/7

This report investigates potential organizations for automated distributed sensor networks (DSNs), i.e., dispersed nodes that can pool their information to perform accurate situation assessment. Laboratory experiments using a message puzzle task indicate that an 'anarchic committee' organization, in which all nodes communicate with one another, consistently outperforms the 'dynamic hierarchical cone' organization, in which communications are constrained and information must be obtained only from lower level nodes. These experiments support the contention that DSNs must emphasize cooperative problem solving rather than problem reduction or subgoaling. A computer based design that minimizes redundant communications in hierarchical organizations by using model based reasoning to form expectations that guide, limit, and reduce reporting frequency is described. Finally, a method for representing hypotheses to minimize communication requirements--the process assembly network--is suggested. This concept uses active 'hypotheses processes' that are responsible for predicting their own evolution over time. GRA

N81-10246# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
AN ANALYSIS OF OBJECTIVE MEASURES FOR USER ACCEPTANCE OF VOICE COMMUNICATIONS SYSTEMS Final Report
Thomas P. Barnwell, III and William D. Voiers, (Dynastat, Inc., Austin, Tex.) Sep. 1979 222 p refs
(Contract DCA100-78-C-0003)
(AD-A089210; E21-659-78-TB-1) Avail: NTIS HC A10/MF A01 CSCL 17/2

The report presents the results of a large study of the statistical correlation between a data base of subjective speech quality measures and a data base of objective speech quality measures. Both data bases were derived from approximately eighteen hours of coded and distorted speech. The subjective test used was the Diagnostic Acceptability Measure (DAM) test. The objective measures included spectral distance measures, frequency variant spectral distance measures, signal to noise measurements, area ratio distance measures, log area ratio distance measures, PARCOR distance measures, log PARCOR distance measures, feedback coefficient distance measures, log feedback coefficient distance measures, residual energy ratio distance measures, and composite measures. The analysis procedures included linear regression analysis, multiple linear regression analysis, and nonlinear regression analysis. In all, approximately 1,500 variations of these objective measures were studied. The figure of merit used for measuring the performance of an objective measure was the estimated correlation coefficient between the objective measure and the subjective data base. Parametrically different distance measures were compared using nonparametric pairwise rank statistics. The results of this study give quantitative predictions of the performance of many objective speech quality measures for predicting subjective user acceptance. GRA

N81-10247# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ANALYSIS AND MEASUREMENTS OF THREE-DIMENSIONAL ARBITRARILY-SHAPED DIELECTRIC SCATTERS Interim Report, 1 Sep. 1978 - 31 Jan. 1980
J. J. H. Wang and C. Papanicolopulos Griffiss AFB, N.Y. RADC May 1980 102 p refs
(Contract F19628-78-C-0223; AF Proj. 2305)
(AD-A089412; RADC-TR-80-167) Avail: NTIS HC A06/MF A01 CSCL 20/3

Theoretical and experimental research was conducted to determine the electromagnetic scattering from heterogeneous dielectric bodies. The discrepancies in the literature regarding the singularity of the electric dyadic Green's functions were resolved. Compact range scattering measurements at 1 GHz were successfully performed. Extensive computations were made for a variety of dielectric scatterers, including a one foot bird at 1 GHz. The agreements between measurements and computation were good except for the resonant sphere, for which the calculated resonant frequencies were shifted by about 20 percent. Various numerical techniques, to treat symmetrical scatterers, using symmetric matrices, banded matrices, and virtual memory were implemented in the Volume Integral Equation algorithm. GRA

N81-10248# Threshold Technology, Inc., Delran, N. J.
DLMS VOICE DATA ENTRY Final Technical Report, 28 Sep. 1978 - 16 Nov. 1979
Phillips B. Scott Griffiss AFB, N.Y. RADC Jun. 1980 52 p
(Contract F30602-78-C-0327; AF Proj. 4303)
(AD-A089198; RADC-TR-80-220) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes the design, principles of operation, and performance characteristics of an Advanced Development Model of a voice recognition system (VRS) which can serve to input cartographic data to a computer. The completed system has been installed at the Defense Mapping Agency Aerospace Center (DMAAC) at St. Louis, MO, for evaluation and testing. The VRS is intended for use in entering by voice cartographic data to the Digital Landmass System (DLMS) Data Base. It was designed to satisfy the DMAAC product specifications. The software developed for the VRS includes two complete stand-alone programs. Performance tests conducted at TTI disclosed an average system word recognition accuracy of just under 99 percent for five talkers. The recognition tests were conducted by the use of tape recordings. These tape recordings were made during a previous contract involving cartographic data entry. Each person spoke approximately 536 words after uttering five training repetitions. The test results were virtually identical to those obtained during the previous contract. GRA

N81-10249# University of Southern California, Marina del Rey. Information Sciences Inst.
A DISTRIBUTABLE, DISPLAY-DEVICE-INDEPENDENT VECTOR GRAPHICS SYSTEM FOR COMMAND AND CONTROL
Richard Bisbey, II and Dennis Hollingworth Jul. 1980 41 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A089596; ISI/RR-80-87) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report documents a distributable, device-independent vector graphics system developed by ISI for the Defense Advanced Research Projects Agency. It describes the system architecture, communications elements, and a phased implementation strategy. The system supports graphics-based command and control applications in distributed computational environments such as the ARPANET. The system has been in use at ISI and at the Naval Ocean Systems Center (NOSC) in the Advanced Command and Control Architectural Testbed (ACCAT) since January 1977. The principal aim of the development effort is the device-independence of the vector graphics. 'Device-independence' means that graphic application programs can be written without regard to the particular display-device on which the output will ultimately be displayed. This system achieves display-device independence by providing the application program with a set of generic, two dimensional vector graphic primitives by which pictures can be described and interacted with at the application level. The particular graphics model used structures pictures as sets of subpictures that are absolute-transformed-segments, as defined by Newman and Sproull. GRA

N81-10250# R and D Associates, Marina Del Rey, Calif.
ELECTROMAGNETIC SCATTERING BY AN OBJECT EMBEDDED IN A STRATIFIED MEDIUM Final Report
Maurice I. Sancer, Scott Siegel, and Dennis S. Goodrow Aug. 1980 94 p refs
(Contract F29601-78-C-0098; AF Proj. 3763)
(AD-A089649; AD-E200557; RDA-TR-110400-002; AFWL-TR-80-30) Avail: NTIS HC A05/MF A01 CSCL 20/14

A general electromagnetic scattering formulation is presented for the situation in which a perfectly conducting body is embedded in a horizontally or radially stratified medium. The electric field integro-differential equation (EFIDE) and magnetic field integral equation (MFIE) are derived for the determination of the surface current density induced on the body by a general class of sources. Expressions are also presented for the use of the current density to determine the electric and magnetic fields scattered by the body into any layer of the medium. Detailed expressions for the MFIE and EFIDE are presented for the horizontally stratified two-layered medium configuration corresponding to the object being in a vacuum half-space above a lossy half-space. A computer code, which is an extended version of NEC-2A, is developed for the solution of the two-layer MFIE for a situation where the object is a model of an aircraft. Results corresponding to special cases obtained by this computer code are compared to experimental data as well as to numerical results obtained by another independently developed computer code. GRA

N81-10251# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.

SYMMETRY IN ELECTROMAGNETIC SCATTERING FROM A CLUSTER OF SPHERES Technical Report, Apr. 1978 - Jun. 1979

O. I. Sindoni, F. Borghese, P. Denti, and G. Toscano Aug. 1980 16 p refs Prepared in cooperation with Messina Univ., Italy

(DA Proj. 1T1-61102-A-71A)

(AD-A089648; AD-E410300; ARCSL-TR-79066) Avail: NTIS HC A02/MF A01 CSCL 20/3

In this study, a method for calculating the scattering properties of a cluster of dielectric spheres was developed and group theory was applied to simplify the calculations. The scattered field as well as the scattering and absorption cross sections can be computed without any restriction on the angle of incidence of the light or on the radii and refractive indices of the spheres in the cluster. GRA

N81-10252# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).

DYNAMIC SPREAD SPECTRUM TIME DIVISION MULTIPLE ACCESS (SS/TDMA)

G. B. Alaria, P. Bostica, R. DeBassa, P. Destefanis, E. Guarene, G. Lobisch, R. Preti, and A. Tonietti Feb. 1980 158 p

(Contract ESTEC-3657/78-NC-AK(SC))

(ESA-CR(P)-1320) Avail: NTIS HC A08/MF A01

A demand assignment procedure, the conceptual design of the onboard processor, and the evaluation of hardware complexity and system performance were studied. A demand Assignment Spread Spectrum Time Division Multiple Access system (DA/SS/TDMA) as a back-up for terrestrial network, and a DA/SS/TDMA system suitable for overload traffic were also studied. Both systems are functionally described. Assignment procedures and frame organizations are detailed as well as the conceptual designs. Hardware complexity and reliability problems are analyzed. In a practical example it is shown how some channel saving in a redundant terrestrial network can be obtained if a satellite stand by DA system is provided. Author (ESA)

N81-10253# Telefonaktiebolaget L. M. Ericsson, Moelndal (Sweden). MI Div.

BROADBAND MICROSTRIP ARRAY ANTENNA

Ingmar Karlsson 21 Mar. 1980 5 p refs

(MI-A-0112) Avail: NTIS HC A02/MF A01

A broadband (13 percent) microstrip array antenna with high efficiency, low cost and low weight was designed and evaluated. The antenna is foam supported and is 0.15 lambda thick. The feeding is accomplished by a separate microstrip network. This antenna is compared with two dielectric loaded microstrip antennas, one with a separate stripline feed network and one with an integrated microstrip network. The foam supported antenna gave lower costs and better electrical performance. Author (ESA)

N81-10254# Telefonaktiebolaget L. M. Ericsson, Moelndal (Sweden).

INTERNATIONAL SOLAR POLAR MISSION SATELLITE HIGH GAIN ANTENNA (ISPM HGA) CONICAL SCAN SIGNAL: A STUDY NOTE

Magnus Bonnedal 20 Dec. 1979 18 p

(MI-A-9361) Avail: NTIS HC A02/MF A01

The conical scan signal was calculated for a perfect reflector and for different tilt angles. The influence of a distorted reflector was also studied. The measured radiation pattern from a coaxial feed at 2.111 GHz was utilized. The results are presented in graphs. Author (ESA)

N81-10255# Telefonaktiebolaget L. M. Ericsson, Moelndal (Sweden). MI Div.

POLARIZATION CHARACTERISTICS IN TERMS OF THE COMPLEX POLARIZATION FACTOR p

Lars G. Josefsson 29 Jan. 1976 10 p refs

(MI-KD-6051) Avail: NTIS HC A02/MF A01

An alternative expression to Beckman's description of the polarization efficiency of a receiving antenna is derived, by means of a systematic definition of coordinate systems. The meaning of orthogonal polarization and cross polarization becomes clear and suitable expressions are more readily obtained. Author (ESA)

N81-10256# Atomic Weapons Research Establishment, Aldermaston (England).

THE CALCULATION OF RADAR CROSS SECTIONS

R. Pizer London Apr. 1980 94 p refs

(AWRE-O-44/79; BR73529; ISBN-0-85518-135-4) Avail: NTIS HC A05/MF A01; HMSO £2.50 PHI

The FORTRAN program CHAOS, used for calculating cross sections is described including the physical approximations used to simplify Maxwell's equations. The scattering bodies are extended to both open and closed surfaces. The numerical methods used are supplied. The problems of wire junctions, of finite conductivity and the attaching of lumped loads to the structure are considered. Techniques for dealing with bodies having rotational or left-right symmetries are examined as well as the sparse matrix approximation and the complex frequency version of CHAOS. The formula used to calculate the impedance matrix elements, and the conventions adopted concerning coordinate systems and polarization are included. Author (ESA)

N81-10257# Royal Radar Establishment, Malvern (England).

SOME OBSERVATIONS ON THE SIGNIFICANCE OF ORTHOGONAL MODES IN ANTENNA ANALYSIS BY THE METHOD OF MOMENTS

T. E. Hodgetts London HMSO Nov. 1979 17 p refs

(RSRE-3238; BR72753) Avail: NTIS HC A02/MF A01

The so-called orthogonal modes which appear in the context of boundary-value problems in electromagnetic field theory are examined. It is proven that any problem describable in terms of a linear operator equation with a symmetric matrix representation of the operator possesses a set of characteristic orthogonal modes, such that when the problem is re-formulated in terms of the characteristic modes the matrix of the operator becomes diagonal. The value of this fact is discussed, and some practical methods of performing the diagonalizing reformulation are described and compared. Author (ESA)

N81-10258# National Telecommunication Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.

EFFECT OF SMALL FREQUENCY CHANGES ON THE RADIATION PATTERNS OF MF (AM) DIRECTIONAL ANTENNAS

Arthur C. Stewart and John B. Heffelfinger May 1980 61 p refs

(PB80-199433; NTIA/Rept-80/39) Avail: NTIS HC A04/MF A01 CSCL 17B

A study was conducted both theoretically and experimentally to determine the magnitude of the radiation pattern changes that would be caused by a plus or minus 4 kHz frequency change for stations using directional antenna arrays. Additionally, a computer study of the 1430 kHz regional channel was conducted to determine the effects of a plus or minus 4 kHz frequency change on the interference levels suffered by co-channel stations. The results of the study demonstrate that the effects of small frequency changes on the radiation patterns of directional antenna arrays are greater in particle than theoretical predictions would

indicate, but that the required pattern corrections could probably be quickly and easily effected. GRA

N81-10259# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
PROPAGATION EFFECTS IN SPACE/EARTH PATHS
H. J. Albrecht, ed. Aug. 1980 509 p refs Presented at the Electromagnetic Wave Propagation Panel Symp., London, 12-16 May 1980
(AGARD-CP-284; ISBN-92-835-0269-8) Avail: NTIS HC A22/MF A01

The effects of electromagnetic wave propagation on paths between locations on or near the Earth surface and a position in space are discussed. The topics included: general tropospheric effects; experimental data on SHF/EHF paths; remote sensing; general ionospheric dispersion effects; new data on ionospheric irregularities and propagation limitations in the systems. For individual titles, see N81-10260 through N81-10297.

N81-10260# Bradford Univ. (England). Dept. of Electrical Engineering.
CHARACTERISATION OF THE EFFECTS OF THE LOWER ATMOSPHERE
P. A. Watson *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 p 9 refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

The ability to predict the attenuation experienced on Earth space radio links for any satellite-Earth station configuration in terms of the percentage time given attenuation thresholds are exceeded on average, and in terms of statistics of fade duration is discussed. The on-average occurence of cross polarization and the relationship of this to the occurrence of attenuation is predicted along with the magnitude of incoherent emissions (thermal and forward scatter) causing an enhanced noise background on coherent radio systems. Characterization of off axis scattering from atmospheric structures, causing interference between systems and characterization of any other channel impairments, for example dispersion, which may place limits on broadband systems operation is discussed. R.K.G.

N81-10261# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
TROPOSPHERIC PROPAGATION EFFECTS ON EARTH-SPACE LOW ELEVATION ANGLE PATHS
Richard K. Moore *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 19 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

Extensions and reduction of horizon distance were determined for a satellite transmitter under climatologically realistic conditions for refraction in the troposphere. The increase in elevation (grazing) angle was determined under the same conditions. The computations were made, where possible, using parameters available climatologically on a global basis. The effects of normal variations in refractivity, of ducting, and of subrefraction were all considered. Likely limits were placed on the basis of climatology. Examples considered show possible variations in horizon distance from 22 km closer than for a vacuum under extreme conditions of subrefraction to 340 km beyond the free space horizon for an extreme duct condition. Horizon variations due to variations in surface refractivity with normal refraction amount to 109 km. Grazing angle variations between minimum and maximum surface refractivity amount to only about 5 mr, but in a duct they may become as great as 32 mr. R.K.G.

N81-10262# Essex Univ., Colchester (England).
A REVIEW OF THEORETICAL PREDICTION TECHNIQUES OF TRANSMISSION PARAMETERS FOR SLANT-PATH, EARTH-SPACE COMMUNICATIONS
B. G. Evans and A. R. Holt *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 17 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

A review of the methods needed to calculate transmission parameters such as attenuation and cross polarization due to a precipitation filled medium on an Earth-space path are given. A comparative view of the electromagnetic techniques associated with single particle scattering as applied to rain and ice are given. A model which is composed partly of ice and partly of rain is proposed and some results of its application are given. The importance of the ice/rain model in determining actual cross polarization on a satellite path are discussed. In addition, details of backscattering calculations which have been performed are presented. Some results of the extension of the theoretical techniques to millimeter waves are given. R.K.G.

N81-10263# Bradford Univ. (England).
PLANE WAVE SPECTRUM TREATMENT OF MICROWAVE SCATTERING BY HYDROMETEORS ON AN EARTH-SATELLITE LINK
D. P. Haworth *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 11 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

For satellites operating at frequencies above 10 GHz, the effects of propagation through atmospheric hydrometeors are of major importance. In particular, the hydrometeors attenuate, cross polarize and scatter signals causing respectively: a loss in signal level, a decrease in the efficiency of dual polarized channels and station to station interference. For large Earth station antennas operating at high frequencies, the near or Fresnel region of the antenna can extend several kilometers from the antenna and consequently, during disturbed weather, a significant proportion of the hydrometeors affecting propagation are in the near or Fresnel region of the antenna. Previous treatment of propagation through hydrometeors in the Fresnel region of an antenna has proved unsatisfactory and the plane wave spectrum technique was used to accurately characterize antenna scatterer interaction in both the near and far fields of an antenna. The Van de Hulst refractive formula for the coherent propagation and the basis of the radiative transfer equation for the incoherent scattering are derived. R.K.G.

N81-10264# Shape Technical Center, The Hague (Netherlands).
THE FREQUENCY DEPENDANCE OF MICROWAVE PROPAGATION THROUGH RAINFALL
P. T. Thompson, A. W. Dissanayake, and P. A. Watson *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 9 p refs Prepared in cooperation with Bradford Univ., England (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

The prediction of rainfall induced attenuation and depolarization at various microwave frequencies is discussed. Experiments are conducted to evaluate such effects on both terrestrial and satellite paths. The sensitivity of the prediction of rainfall induced attenuation and depolarization to various meteorological parameters is discussed. Regression analysis of the resulting predicted propagation factors leads to a simple formulation of such effects. For attenuation in particular the implications of scaling in frequency from one band to another are presented with respect to the use of such regression techniques. It is pointed out that such frequency scaling is not straight forward. S.F.

N81-10265# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SIMULATION OF EHF PROPAGATION THROUGH THE ATMOSPHERE
J. D. Hopponen *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 11 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

The effect of the clear, nonturbulent air mass on the propagation of extremely high frequency radio waves at various slant path angles is examined. Molecular absorption spectra (principly of O2 and H2O) cause frequency dependent signal attenuation, phase delay, ray bending, and medium noise. The interaction between the physical environment and the traversing radiation is expressed by a complex refractivity Nc, which is a function of frequency f, total pressure p, partial water vapor pressure Pw, and temperature T. The Earth's magnetic field strength, which enters into Zeeman splitting of the absorption lines at high altitudes, is regarded as a nearly negligible background parameter. The means of calculating Nc utilizes a recent spectroscopic data base for the 60 GHz oxygen band and the 22.235 GHz water vapor line. In addition to the 183 GHz water vapor line, 6 higher frequency lines plus a nonresonant term

are included. A distribution of the gas variables P, Pw, and T for the neutral air (surface to 80 km) leads to a profile of Nc which provides the basis for calculating the various propagation effects along a specified radio path (ground to ground, aircraft, or spacecraft. The distribution of atmospheric data may be obtained from in situ soundings (e.g., radiosonde) or from standard atmospheric models. The computer model assumes a symmetric, spherically stratified atmosphere in which the layers need not be regarded as homogeneous, as a consequence of the interpolation methods developed for Nc. Noise integrals are detailed. S.F.

N81-10266*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
RADAR ESTIMATION OF SLANT PATH RAIN ATTENUATION AT FREQUENCIES ABOVE 10 GHz AND COMPARISONS WITH MEASURED MULTI-SEASON RESULTS
Julius Goldhirsh *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 12 p refs (For primary document see N81-10259 01-32)
(NASA Order S-40113-B)
Avail: NTIS HC A22/MF A01 CSCL 20N

Techniques and results pertaining to estimating Earth satellite path rain attenuation events and statistics using radar at nonattenuating wavelengths are presented. The radar formulation and beam scanning methods are described and the procedure for relating the radar measured Rayleigh reflectivity to the high frequency Mie attenuation coefficient are given. Examples of radar derived single terminal statistics and estimation criteria as they relate to path angle and frequency are reviewed. Radar derived space diversity statistics and their dependence on terminal spacing and frequency are described. Site diversity performance curves obtained by radar and radiometry are compared with each other demonstrating the utility of radar methods. Results of a multi-year experiment to test, refine, and establish accuracies of radar methods for arriving at estimates of rain attenuation along an Earth-satellite path are discussed. Comparisons of measured and radar estimated fade events are presented and found to be good. Comparisons of cumulative fade distributions show agreement to be excellent giving an rms deviation of 1 dB. S.F.

N81-10267# Science Research Council, Slough (England).
DUAL-POLARIZATION RADAR DATA FOR EVALUATION OF EARTH-SPACE RADIO LINK ATTENUATION
M. P. M. Hall, S. M. Cherry, and J. W. F. Goddard *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 10 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

Using conventional radar data to assess attenuation due to rain on Earth space paths requires the assumptions that the drops have a particular statistical distribution of sizes, and that the drops are of water. In the very localized regions of intense rain which influence such paths most severely, these assumptions can lead to large errors. Comparisons between direct measurements of attenuation and those computed using data from a dual-polarization radar technique are presented. This technique reduces the errors of radar-derived estimates of attenuation. It also gives a clear distinction between ice and water. By contrast, estimation of attenuation using raingauge data is of less value. S.F.

N81-10268# Science Research Council, Slough (England).
REVIEW OF SLANT PATH PROPAGATION MEASUREMENTS MADE AT THE APPLETON LABORATORY, SLOUGH, UNITED KINGDOM
P. G. Davies and E. C. Mackenzie *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 22 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

An evaluation of the degradation of system performance due to atmospheric attenuation of radio communications is presented. The OTS and SIRIO satellites were used to characterize the properties of the transmission medium along space to Earth and Earth to space paths. Transmissions at frequencies above 10 GHz were considered. T.M.

N81-10269# Post Office Research Dept., Ipswich (England).
THE 20 AND 30 GHz SLANT-PATH PROPAGATION MEASUREMENTS AT MARTLESHAM HEATH, UNITED KINGDOM
J. Thirlwell and R. G. Howell *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 9 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

A summary of some of the measurements carried out at the Post Office Research Center during 1975 to 1976 using the 20 and 30 GHz linearly polarized transmissions from the ATS 6 satellite is presented. The measurement of attenuation ratio between the two frequencies and depolarization measurements at 20 GHz are presented. Calibration of 20 and 30 GHz radiometers directed along the slant-path was carried out. The results of these measurements are compared with a theoretical model and the CCIR depolarization equation. Also the statistical data for depolarization and attenuation is presented. The need to present depolarization/attenuation data in the joint probability of occurrence form is emphasized. Due to nonattenuating ice depolarization effects, there is no simple relationship between depolarization and attenuation. The long term radiometer derived attenuation data is also presented and comments on scintillation at elevation angles from 30 deg down to the horizon are made. T.M.

N81-10270# Birmingham Univ. (England). Dept. of Electronic and Electrical Engineering.
A REVIEW OF SOME CROSS-POLARIZATION EFFECTS ON SLANT PATHS IN THE 11-30 GHz FREQUENCY RANGE
T. Pratt *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 9 p refs Supported in part by Science Research Council (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

The results of experimental observations of fading and cross-polarization at 30 GHz on a slant path to central England are summarized. The wide variation in cross-polarization caused by ice particles in the propagation path which was observed at sites in the UK and USA were examined. Some results for propagation on slant paths at low elevation angles are presented showing reliable conditions at angles as low as 2 deg. Several events in which cross-polarization was caused by ice clouds are discussed, for a number of frequencies and sites, and one event showing cross-polarization in clear air is presented. The performance of typical analogue and digital satellite communication links using the 20 and 30 GHz bands was examined. Atmospheric cross-polarization does not seriously degrade the performance of the link, particularly at 30 GHz, when frequency reuse by orthogonal polarizations is employed. T.M.

N81-10271# Bell Telephone Labs., Inc., Holmdel, N. J.
ATTENUATION, DEPOLARIZATION AND DISPERSION BY ATMOSPHERIC HYDROMETERS ALONG A 19 AND 28 GHz EARTH-SPACE RADIO PATH
D. C. Cox, H. W. Arnold, H. H. Hoffman, and R. P. Leck *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 11 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

Quantitative relationships relating attenuation, depolarization, and dispersion measured at 19 and 28 GHz along an Earth-space path to a COMSTAR satellite are presented. Median rain and ice depolarization was minimized for linear polarizations oriented horizontally and vertically at the Earth terminals. Median depolarization was maximized for 45 deg linear polarization and circular polarizations. Maximum depolarization was at least 10 dB to 20 dB greater than the minimum. Phase and amplitude dispersion due to rain and other atmospheric processes was minimal and should not affect the performance of wide bandwidth satellite communication systems. T.M.

N81-10272# Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Studio per le Telecommunicazioni Spaziali.
RESULTS OF PROPAGATION EXPERIMENTS AT ITALIAN TERMINALS USING THE SIRIO SATELLITE
F. Carassa, M. Mauri, and A. Paraboni *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 4 p ref (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

Attenuation data in two bands, acquired throughout two years of experiment, are presented and compared to each other.

Preliminary data about fade duration and fade rate of variation are also presented. Deep fade occurred only during heavy rain events: as a consequence a significant year-to-year and site-to-site variability was observed because of the remarkable time and space non-uniformity of the climatology existing throughout Italy. T.M.

N81-10273# *Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).*

USING RADAR TO STUDY THE ATTENUATION AND DEPOLARIZATION OF SUPERHIGH FREQUENCIES OBSERVED OVER AN OBLIQUE COURSE [UTILISATION D'UN RADAR POUR ETUDIER L'ATTENUATION ET LA DEPOLARISATION DES HYPERFREQUENCES OBSERVEES SUR UN TRAJET OBLIQUE]

P. Gole, J. P. Mon, and P. Ramat In AGARD Propagation Effects in Space/Earth Paths Aug. 1980 10 p refs In FRENCH (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

Interest in using radar to study signal propagation is discussed with emphasis on attenuation and depolarization prediction, and the evaluation of signal reception at various locations. During a two month period, the reflectivity mode over the Paris area was measured with the aid of a Ronsard system radar and data obtained in the 11 GHz band with the aid of the OTS satellite. In determining the a and b parameters of the empirical relation A = Z sub b, it was possible to calibrate the radar by linking the attenuation (A) and the measured reflectivity (b). Further measurements are needed to establish a satisfactory correlation between the polarization and reflectivity uncoupling.

Transl. by A.R.H.

N81-10274# *Dutch Post Office, Dr. Neher Lab., Leidschendam. Transmission Div.*

JOINT STATISTICS OF ATTENUATION AND CROSS-POLARIZATION MEASURED WITH THE OTS SATELLITE

J. VanCappellen, A. Mawira, and J. Neessen *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 10 p refs (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

Methods which can be applied to the calculation of the fading margin in satellite communication systems using orthogonally polarized radio channels are considered. A transmission model is introduced and it is discussed whether the joint statistics or the separate statistics of XPD and attenuation can be used for the determination of the fading margin. Propagation data are presented, which were collected with the experimental Earth station at Nederhorst den Berg by measurements on OTS beacons. The measured data are used for the evaluation of the methods, which are presented for the calculation of the fading margin.

J.M.S.

N81-10275# *Technische Hogeschool, Delft (Netherlands). Microwave Lab.*

RAIN ATTENUATION PREDICTION AT THE NETHERLANDS OTS/SIRIO RECEIVING SITE USING INEXPENSIVE X-BAND RADAR

E. P. W. Attema and H. J. M. Heemskerk (Dutch Post Office, Dr. Neher Lab., Leidschendam) *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 11 p refs (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

Along with OTS propagation experiments at The Netherlands experimental groundstation, radar reflectivity profiles along the slant path to the satellite were recorded at X-band using an inexpensive mass-produced ship's navigation radar transceiver, slightly modified to produce accurate reflectivity data at X-band. Based on the system parameters, the radar equation for distributed targets is derived, expressing the average reflected power in terms of a radar calibration factor, radar range and reflectivity. Using Laws and Parsons dropsize distribution the theoretical relation between reflectivity and attenuation at the radar frequency (9.4 GHz) and the satellite beacon frequency (11 GHz) were calculated. Following a discussion of some hardware aspects and the residual uncertainties in the attenuation estimates selected precipitation events are examined. Overall correlations are given between radar derived attenuation values and those actually measured. Finally radar derived attenuation statistics are compared to radiometer derived statistics and direct measured results using the OTS beacon. Author

N81-10276# *Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.*

OTS PROPAGATION MEASUREMENTS AT EINDHOVEN UNIVERSITY, NETHERLANDS

J. Dijk, C. N. F. Hansen, and E. J. Maanders *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 14 p refs (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

Since the launch of O.T.S.-2 in May 1978 nearly permanent reception of the TM and B sub 0/B sub 1 beacon took place, with respect to attenuation on the path satellite-groundstation. A large amount of fades could be registered, the largest of about 15 dB lasting nearly 10 minutes. Daily variations of the TM beacon of 500 Hz and long time variations over a period from June 1978 to October 1979 of more than 5000 Hz have been recorded. The B sub 0 beacon showed very large frequency variations of 20 to 30 kHz per day and long time variations of about 130 kHz over the same period as the TM variations. Statistical material, inclusive cumulative distributions became available over the entire period of measurements. Author

N81-10277# *Deutsche Bundespost, Darmstadt (West Germany). Research Inst.*

THE 11-GHz PROPAGATION MEASUREMENTS ON SATELLITE LINKS IN THE FEDERAL REPUBLIC OF GERMANY

Fritz Dintelmann and Friedrich W. Ruecker In AGARD Propagation Effects in Space/Earth Paths Aug. 1980 9 p refs (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

Research programs on wave propagation above 10 GHz along Earth-space paths found nearly ideal conditions for their research with the launch of the Italian SIRIO satellite in 1977, and the OTS 2 in 1978. Both, attenuation and depolarization measurements are carried out. Since the SIRIO satellite provides a coherent three-line spectrum in a 532 MHz band, the attenuation characteristic and differential phase effects can be studied. OTS, on the other hand, allows meaningful polarization measurements because its telemetry signal is transmitted in linear polarization and its other emissions in the band are circularly polarized. Hence, the performance of linear polarization can be judged against that of circular polarization on the same link. In addition to these measurements, point rainfall intensities are recorded at various locations in the vicinity of the ground station. L.F.M.

N81-10278# *Royal Norwegian Council for Scientific and Industrial Research, Kjeller.* Environmental Surveillance Technology Programme.

TARGET ADAPTIVE RADAR, PROPAGATION MEDIUM ADAPTIVE COMMUNICATION SYSTEMS, PRESENT DAY METHODOLOGY AND FUTURE PERSPECTIVES. A REVIEW

Dag T. Gjessing *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 21 p refs (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

With recent advances in radio science and growing interest in environmental monitoring, remote sensing based on electromagnetic waves became an important field of study. Using a radar system in which the illuminating frequency can be controlled by a computer system and likewise the receiving system can be matched to the backscattered signal, a system which adapts itself both to the transmission medium and to a target of special interest can be designed. From information theory it is well known that the more information one requires, the wider must the bandwidth of the communication channel be. In terms of radar terminology, the more information we require about the target, the more widebanded must the illuminating radar wave be. The radar wave must pass through the intervening propagation medium with a minimum of distortion, and at the same time, upon reflection by the object of interest give optimum information about this object. L.F.M.

N81-10279*# *Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.*

USE OF A SATELLITE MULTI-FREQUENCY RADIOMETER TO DETERMINE ATTENUATION SUFFERED BY A SATELLITE RADAR

G. J. Dome, R. K. Moore, I. J. Birrer, and K. VanSickle In AGARD Propagation Effects in Space/Earth Paths Aug. 1980 12 p refs Sponsored by NASA (For primary document see *N81-10259 01-32*)

Avail: NTIS HC A22/MF A01 CSCL 20N

The antenna temperature of the radiometer observing the sea without attenuation can be calculated, for vertical polarization and at Seasat Scanning Multifrequency Microwave Radiometer (SMMR's) 49 deg angle of incidence, if the surface temperature is known. Thus, an increase in the observed value above this value is an excess temperature caused by attenuation in the atmosphere. The amount of this excess temperature was determined for various model cloud and rain conditions, as was the attenuation. An empirical relation was determined between excess temperature at 37 GHz and 18 GHz, and the attenuation at 14.6 GHz. An algorithm was then developed to use the 37 GHz radiometer to establish small attenuations and the 18 GHz radiometer to establish moderate attenuations and large attenuations. This method was tested against some of the early Seasat observations, and was shown to be reasonably successful, within limitations posed by poor knowledge of the actual attenuation with which the results for the algorithm must be compared. L.F.M.

N81-10280# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.

THE EFFECT OF TURBIDITY ON REMOTE SENSING OF OCEAN COLOR

G. Metzig and E. Raschke In AGARD Propagation Effects in Space/Earth Paths Aug. 1980 6 p refs (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

Accurate correction for the atmospheric effects on the backscattered radiation of multispectral satellite measurements is described. A one dimensional radiative transfer model for the atmosphere-ocean system is presented. T.M.

N81-10281# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.

RADIO BEACON STUDIES OF IONOSPHERIC IRREGULARITIES

Kenneth Davies *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 *AO1 refs Presented at the NATO/AGARD* Symp., London, May 1980 (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

Satellite observations of ionospheric irregularities with dimensions ranging from thousands of kilometers to around 100 meters are discussed. These observations were made using the ATS 6 synchronous satellite. European values for the total columnar electron content and the plasmaspheric columnar electron content are larger than those over the USA. Maps of electron content were used in making corrections for ionospheric refraction. Multifrequency observations of Fresnel type fading by intense irregularities were used to determine some properties of the irregularities. T.M.

N81-10282# University Coll. of Wales, Aberystwyth. Dept. of Physics.

AN EMPIRICAL MODEL OF IONOSPHERIC SLAB THICKNESS

L. Kersley *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 8p refs (For primary document see N81-10259 01-32)

(Grant AF-AFOSR-2267-72)

Avail: NTIS HC A22/MF A01

An empirical model of slab thickness was developed. The model is combined with foF2 to estimate total electron content and hence group delay for prevailing conditions in timing and positioning systems. T.M.

N81-10283# Nebraska Univ. - Lincoln. Dept. of Electrical Engineering.

ANISOTROPIC MEDIUM EFFECTS ON THE PROPAGATION OF 1.5 GHz SIGNALS CODED BY PHASE REVERSALS: FULL-WAVE SOLUTIONS

E. Bahar and B. S. Agrawal *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 10p refs Submitted for publication Sponsored in part by NSF and ARO (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

The distortion and depolarization of 1.5 GHz transient signals that propagate through an inhomogeneous anisotropic model of the ionosphere were investigated using a full wave approach. In addition to determining the signal delays and the phase shifts of the transmitted signals, features that distinguish between the depolarized and nondepolarized signals were also identified. T.M.

N81-10284# Universite Catholique de Louvain (Belgium). Lab. de Telecommunications et dHyperfrequences.

THE 1979-1980 DATA PROCESSING AND RESULTS FROM THE OTS BEACONS B0/B1 AND TM, AND RADIOMETRY AT 11.4 AND 35 GHz

A. Vandervorst and P. Sobieski *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 14p refs (For primary document see *N81-10259 01-32*)

Avail: NTIS HC A22/MF A01

Measurements on the beacons of the OTS satellite are presented. Measurements by a dually polarized radiometer at 12 GHz and by a radiometer at 35 GHz are also presented. These measurements yielded the simultaneous recording of the copolar and the crosspolar components of the beacon, two sky temperatures at 12 GHz in orthogonal linear polarization as well as the differential sky temperature at the same frequency, and the sky temperature at 35 GHz. Data processing was improved to compensate for regular variations of the clear sky level of the copolar signal, the crosspolar discrimination and its phase. T.M.

N81-10285# General Electric Co., Syracuse, N.Y.

IONOSPHERIC DISPERSION EFFECTS ON WIDEBAND TRANSMISSIONS

George H. Millman and Kurt A. Olsen *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 12p refs (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

An evaluation was made of the effects of the dispersive characteristics of the ionosphere on a frequency-modulated and an unmodulated, no frequency modulation, Gaussian shaped pulse. The distortion of the signal amplitude, envelope, pulse length, modulation and phase caused by the ionosphere was examined. T.M.

N81-10286# Lancaster Univ. (England). Dept. of Environmental Sciences.

ELECTRON CONTENT MEASUREMENTS AT LANCASTER: HARMONIC ANALYSIS OF ATS-6 MEASUREMENTS

E. M. Poulter and J. K. Hargreaves *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 14p refs (For primary document see N81-10259 01-32)

Avail: NTIS HC A22/MF A01

The radio beacon experiment carried on the ATS 6 satellite allowed the measurement of the signal group delay and hence the electron content along the ray path. The more usual electron content measurement, the Faraday rotation angle, could also be obtained independently. Since this latter quantity represents the electron content weighted by the geomagnetic field, it provides an additional parameter relating to the shape of the electron density profile. Alternatively it may be used to separate the total electron content into ionospheric and protonospheric components during periods of geomagnetic quiet. Additional information on the ionospheric layer shape was obtained from concurrent ionosonde data. These data cover a range of seasonal variations and changing conditions of geomagnetic activity. For consideration of the gross features, the data were reduced to 30 minute mean values, comprising the electron content, shape factor, and slant slab thickness. An adequate empirical description of these parameters is supplied by harmonic analysis. L.F.M.

N81-10287# SRI International Corp., Menlo Park, Calif.

TRANSIONOSPHERIC RADIOWAVE PROPAGATION AND SIGNAL STATISTICS Final Report

C. L. Rino *In* AGARD Propagation Effects in Space/Earth

Paths Aug. 1980 23p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

With the advent of satellites such as NTSS/TRANSIT, ATS 6, and WIDEBAND that carry multifrequency phasecoherent beacons, a large body of phase-scintillation data obtained. These data made important contributions to our overall understanding of scintillation phenomena. Theoretical results that characterize intense scintillation in power-law environments also recently emerged. A unified review of these developments is presented. These together with refinements in morphological models and a rapidly improving comprehension of the instability mechanisms that cause the irregularities, should improve our ability to predict or mitigate the deleterious effects of radiowave scintillation.
L.F.M.

N81-10288# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
RECENT ASPECTS OF IONOSPHERIC SCINTILLATION OBSERVATIONS
G. K. Hartmann *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 12p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

Scintillation occurrence and scintillation intensity depend upon frequency, location, propagation path geometry, geophysical conditions, receiving equipment characteristics, - such like the receiving antenna beamwidth, the receiver resolution and stability, and the data acquisition facilities - and the measure used to describe scintillation. This causes many problems by comparing data from different sources. After fifty years of ionosphere research and more than twenty years of intensive scintillation measurements future experimental trends might be as much determined by some already visible limitations as by the application of the very recent advanced technologies. Both aspects are mentioned here. There are two principally different methods to investigate the scintillation producing irregularities in the ionosphere: 1. In situ measurements, 2. Remote sensing methods. It is shown that three different experimental possibilities to improve our knowledge about the scintillation producing irregularities in the ionosphere. The first one, possibly the most important at present is based upon a new experimental technique (VIGODOS) which possibly will allow a better, faster and easier understandable and more efficient combination of preedited data that stem from radar experiments, satellite radio beacon experiments, aurora and airglow measurements, as well as from in situ experiments.
L.F.M.

N81-10289# Illinois Univ., Urbana-Champaign. Dept. of Electrical Engineering.
STATISTICAL PROPERTIES OF TRANSIONOSPHERICALLY PROPAGATED RADIO SIGNALS UNDER THE INTENSE SCINTILLATION CONDITIONS
K. C. Yeh and C. H. Liu *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 11p refs (For primary document see N81-10259 01-32)
(Grant NSF ATM-77-22485)
Avail: NTIS HC A22/MF A01

The simplest indicator of scintillation activities is the value of scintillation index. There are several scintillation indexes commonly in use, but they are all derived from the amplitude data and they are all related. For precise work the index, which is defined as the fractional mean square deviation of the received power from the mean power, is recommended. This index was found to be rather sensitive to radio frequencies in the weak scatter regime, but increasingly insensitive to radio frequencies in the multiple scatter regime. Such a behavior is also predicted theoretically and has been ascribed to the saturation effects. As for phase, the results are not so consistent possibly because of its sensitivity to the data processing technique. In terms of quadrature components it was found that most of the power resides in the phase-quadrature component in the weak scatter limit, but gradually becomes equalized among the two components as the scintillation index increases. Other considerations such as the power spectrum and the correlation interval of the amplitude, phase and quadrature components were also investigated and reviewed.
L.F.M.

N81-10290# Air Force Geophysics Lab., Hanscom AFB, Mass.
RECENT OBSERVATIONS OF EQUATORIAL AND HIGH LATITUDE SCINTILLATIONS
J. Aarons and H. E. Whitney *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 17 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

At equatorial latitudes, combined airborne and ground measurements of radar backscatter, electron density profiles, scintillations, airglow at 6300 A, and total electron content yielded data on the development and decay of the irregularity patches containing the hundred meter irregularities responsible for amplitude and phase scintillation. The use of airglow measurements from aircraft allowed the form of the patch to be deduced. At auroral latitudes, sheets of irregularities were observed at Poker Flat, Alaska and at Goose Bay, Labrador using phase fluctuations of the WIDEBAND signals. WIDEBAND phase and amplitude deviations when correlated with DMSP photographs show intense activity over diffuse and discrete aurora. The increase of intensity of scintillation activity at equatorial and polar latitudes was noted during 1979 and 1980 when very high solar flux levels were recorded. These increases take place even under quiet magnetic conditions when solar flux is high and take place during the increased number of magnetic storms.
L.F.M.

N81-10291# Communications Satellite Corp., Clarksburg, Md.
THE 4/6-GHz IONOSPHERIC SCINTILLATION MEASUREMENTS
D. J. Fang *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 12 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

Most of the data presented were collected at the Taipei Earth Station from June 1976 to June 1977, the first year of sunspot cycle 21, during which the low solar activity level began to increase. Annual and worst month cumulative statistics for ionospheric scintillations were provided for use in system studies and planning. The worst month statistics varied considerably, depending on the definition of worst month; therefore, a formal definition for engineering applications was warranted. Power spectral density analyses confirmed an f to the minus 3rd power dependence, indicating that the conventional weak scattering theory for a thick screen with a power law electron density fluctuation spectrum of $p = 4$ would be adequate to explain the weak gigahertz ionospheric scintillation events observed at Taipei.
L.F.M.

N81-10292# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
PROPAGATION ANOMALIES AFFECTING AIRBORNE SATELLITE COMMUNICATIONS
Allen L. Johnson *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 12 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

Airborne satellite communication and navigation systems can be disrupted by propagation anomalies. Ionospheric scintillation fading and earth multipath fading can cause 15 to 30 db amplitude fading and over 1000 deg per second phase variations which can reduce message intelligibility and navigation accuracy. The ionospheric scintillation effects are particularly severe in the polar and equatorial regions. The multipath effects are worse over water at low elevation angles to the satellite. Diversity techniques can be used to mitigate the disruptive effects of both the ionospheric scintillation and earth multipath. While frequency, space and time diversity all improve the signal performance against Earth multipath fading, only time diversity offers a significant improvement against ionospheric scintillation fading in an airborne environment.
Author

N81-10293# Naval Research Lab., Washington, D. C.
ENVIRONMENTAL CONSTRAINTS IN EARTH-SPACE PROPAGATION. A REVIEW PAPER
John M. Goodman *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 27 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

The general utilization of space to introduce the importance

of Earth space radio propagation with special emphasis directed toward DoD mission areas are reviewed. An outline of the basic properties of Earth-space RF propagation follows and an assessment of the major effects is given. R.K.G.

N81-10294# *Air Force Geophysics Lab., Hanscom AFB, Mass.*
A PRELIMINARY EVALUATION OF THE TWO-FREQUENCY IONOSPHERIC CORRECTION FOR THE NAVSTAR-GLOBAL POSITIONING SYSTEM
J. A. Klobuchar, H. Soicher (Army Communications Research and Development Command, Fort Monmouth, N.J.), and J. A. Pearson (Aerospace Corp., Los Angeles) *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 10 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

The Navstar Global Positioning System (GPS) is an advanced worldwide navigation system with a design accuracy of 16 meters spherical error probability for 50 percentile in 3 dimensions. The largest potential error source in the navigation system is due to the group path retardation of the Earth's ionosphere which can produce range delays of up to 100 meters on a worst case basis. Analytic models can be utilized to reduce the ionospheric error contribution, but the use of a state of the art ionospheric time delay model is expected to reduce the ionospheric range error by not more than 75 percent, still leaving worst case delays of approximately 25 meters, well above the system design specifications. The ionosphere is a dispersive medium with the amount of the ionospheric time delay proportional to the inverse square of the operating frequency. A second modulated frequency, called L2, was incorporated on the GPS signal structure to allow the system user's receiver to automatically correct for the ionospheric time delay. The initial tests of the correction capability of this dual frequency signal structure was provided by a GPS modulator which was orbited on the NTS 2 satellite in late 1977. The effects of multipath at lower elevation angles are clearly seen as increased system noise, though multipath did not affect the two frequency ionospheric correction capability. R.K.G.

N81-10295# Directorate of Radio Technology, London (England).
THE INTERACTIONS OF A SOLAR POWER SATELLITE TRANSMISSION WITH THE IONOSPHERE AND TROPOSPHERE
K. A. Hughes *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 7 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

In a system of solar power satellites, (SPS), solar energy is collected by a large array of solar cells in geostationary orbit, converted to rf power at microwave frequencies and beamed to Earth for conversion into dc. The propagation of the high power microwave beam through the Earth's atmosphere initiates interactions in the ionosphere and troposphere that have disruptive effects on existing radio services. In addition, the transmission of the SPS beam is also affected. Radio interference on the SPS frequency occurs from scattering of the beam in both the ionosphere and troposphere; more serious broad-band interference may arise from ionospheric modification, resulting from intense ohmic heating. The problems associated with these interactions are discussed and the effects on existing radio services are quantified. S.F.

N81-10296# AEG-Telefunken, Bonn (West Germany).
ON MICROWAVE POWER TRANSMISSION AND THE FEASIBILITY OF POWER SATELLITES FOR EUROPE
Diederich Koehn *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 6 p refs (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

Considerations of giant power plants in remote areas (because of the environmental contamination) or in space suggest or even force a noncable bound transmission of power, e.g., by a collimated microwave beam. However, the propagation of microwaves is affected by tropospheric and ionospheric effects (attenuation, diffraction, reflection, decollimation, depolarization) which degrade the power transmission efficiency. Power satellite concepts are discussed and the principles of the proposed microwave power transmission system are explained. The main interfering atmospheric effects are explained and an appraisal of their influence on the transmission path and the overall power transmission system is given. Some of those effects show a latitudinal dependence, and conclusions on the feasibility of power satellite systems for Europe are derived. S.F.

N81-10297# Institute for Telecommunication Sciences, Boulder, Colo.
POTENTIAL IMPACT OF THE SATELLITE POWER SYSTEM ON COMMUNICATION AND ELECTRONIC SYSTEMS AND THE IONOSPHERE
W. B. Grant, C. M. Rush, and E. L. Morrison *In* AGARD Propagation Effects in Space/Earth Paths Aug. 1980 19 p ref (For primary document see N81-10259 01-32)
Avail: NTIS HC A22/MF A01

The impact of the operation of the satellite power system upon the ionosphere and telecommunication systems is described. Analysis of possible functional and operational degradation of electromagnetic systems (communication systems, radars, navigation aids, satellites) and environment sensitive instruments and systems (computers, sensors, electronic medical instruments and security devices) due to direct SPS power coupling are studied in detail. Development of mitigating techniques when unacceptable degradation is discovered in a given equipment or system is described. Assessment of possible impacts upon telecommunication systems and implications for electromagnetic compatibility are discussed. The degree to which the ionosphere will be modified by the passage of the microwave power beam and what impact this modification has upon telecommunication systems are discussed. Theoretical efforts to simulate SPS operational impacts are described. S.F.

N81-10475*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SIMULATION OF ORBITAL RADAR IMAGES
R. S. Saunders, J. C. Holtzman (Kansas Univ., Lawrence), and Charles Elachi *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 45-63 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 17I

N81-10484*# Geological Survey, Flagstaff, Ariz.
AUTOMATIC SHADING CORRECTION AND SPECKLE NOISE MAPPING/REMOVAL TECHNIQUES FOR RADAR IMAGE DATA
Pat S. Chavez, Jr. *In* JPL Radar Geol.: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 251-262 refs (For primary document see N81-10472 01-42)
(NASA Order W-13130)
Avail: NTIS HC A22/MF A01 CSCL 17I

N81-10960# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
SIMULTANEOUS OBSERVATIONS OF E AND B-ULF WAVES ABOARD A SOUNDING ROCKET PAYLOAD
N. Kloecker, H. Luehr, and R. Grabowski (Fraunhofer Inst. fuer Physikalische Weltraum-Forschung, Freiburg) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 297-299 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10961# Southampton Univ. (England). Dept. of Physics.
ELF/VLF WAVEFIELD MEASUREMENTS MADE AT THE TIME OF LAUNCH OF SKYLARK SL1424
P. Cannon, W. Gibbons (Sheffield Univ., England), B. K. Madahar (Sheffield Univ., England), and L. J. C. Woolliscroft (Sheffield Univ., England) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 301-307 refs Sponsored by UK Science Research Council (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10962# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
MEASUREMENT OF HIGH-FREQUENCY WAVES IN AN AURORAL PLASMA
R. Pottelette and J. M. Illiano *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 309-312

refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10975# Sussex Univ., Brighton (England).
ACTIVE EXPERIMENTS USING THE CHATANIKA AND EISCAT FACILITIES
G. Newton, P. J. Christiansen, and G. Martelli *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 383-385 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-10298 British Library Lending Div., Boston Spa (England).
WORLD DEVELOPMENTS IN ELECTRONIC SWITCHING, PART 1: DEVELOPMENTS WITHIN NATIONAL SYSTEMS
P. Lucas 4 Mar. 1980 10 p refs Transl. into ENGLISH from Ann. des Telecommun. (France), v. 33, no. 11-12, 1978 p 407-436
(BLL-Trans-3710-(7737.470)) Avail: British Library Lending Div., Boston Spa, Engl.

Developments in electronic switching are extremely fast. The 1977 situation in industrialized countries is briefly examined, looking at the main systems under development, and using the most recent international conferences on switching as its main information sources. Author

N81-10299 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A PRACTICAL APPROACH TO INCLUSION OF ELECTROMAGNETIC FIELD NONLINEARITIES IN THE DYNAMIC MODELING OF LARGE TURBOGENERATORS WITH EMPHASIS ON THE INTERACTION BETWEEN MACHINE DESIGN AND SYSTEM STABILITY ASPECTS Ph.D. Thesis
Manoj Ramprasad Shah 1980 204 p
Avail: Univ. Microfilms Order No. 8024016

A rigorous mathematical model for large turbogenerators includes the representation of the stator, field, damper bars as well as the polehead damping. The effect of magnetic saturation on machine inductances is considered by means of numerical analysis of magnetic fields in two dimensions coupled with the concept of amperetum drop functions. Validation of the approach is carried out, using an existing 659 MVA, 4 pole turbogenerator as an example , by comparing its unsaturated as well as saturated values of a few typical reactances (inductances) with corresponding data obtained by employing the established calculation techniques. The effect of instantaneous changes of the saturation status and rotor speed variations on the values of equivalent damping resistances of the solid iron rotor and damper bars was calculated. Subsequently, all the concepts and techniques developed are applied to a nonlinaer dqo discrete-time dynamic model of turbogenerators. Dissert. Abstr.

N81-10300 Illinois Inst. of Tech., Chicago.
AN EXPERIMENTAL IDENTIFICATION METHOD FOR SEQUENTIAL MACHINES Ph.D. Thesis
Gordon Kuo-Hui Lin 1980 138 p
Avail: Univ. Microfilms Order No. 8026150

Techniques for constructing efficient preset checking experiments, called uniform checking experiments, for sequential machines are described. The checking experiment for the sequential machine constructed by using existent methods is preset only for those machines which have synchronizing sequences. Therefore, the derivation of construction techniques for preset checking experiments, called uniform checking experiments, for the sequential machines is investigated. The input sequence of a checking experiment is called a checking sequence. A theorem is given to prove that every sequential machine possesses a uniform checking sequence, although the uniform checking sequence contructed by using the technique given in this theorem is inefficient for machines which possess no synchronizing sequences. Some classes of machines which do not have synchronizing sequences are defined. They are permutation machines, cycle machines, and symmetry machines. Dissert. Abstr.

N81-10301*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Power Conversion Electronics Dept.
APPLICATION HANDBOOK FOR A STANDARDIZED CONTROL MODULE (SCM) FOR DC-DC CONVERTERS, VOLUME 1 Final Report, Jun. 1976 - Jan. 1980
Fred C. Lee, M. F. Mahmoud, and Yuan Yu Apr. 1980 240 p refs Prepared in cooperation with Virginia Polytechnic Inst. and State Univ., Blacksburg 2 Vol.
(Contract NAS3-20102)
(NASA-CR-165172; TRW-29922-6001-RU-01) Avail: NTIS HC A11/MF A01 CSCL 09C

The standardized control module (SCM) was developed for application in the buck, boost and buck/boost DC-DC converters. The SCM used multiple feedback loops to provide improved input line and output load regulation, stable feedback control system, good dynamic transient response and adaptive compensation of the control loop for changes in open loop gain and output filter time constraints. The necessary modeling and analysis tools to aid the design engineer in the application of the SCM to DC-DC Converters were developed. The SCM functional block diagram and the different analysis techniques were examined. The average time domain analysis technique was chosen as the basic analytical tool. The power stage transfer functions were developed for the buck, boost and buck/boost converters. The analog signal and digital signal processor transfer functions were developed for the three DC-DC Converter types using the constant on time, constant off time and constant frequency control laws. R.C.T.

N81-10302# Naval Construction Battalion Center, Port Hueneme, Calif.
SOLID STATE TRANSFORMER CONCEPT DEVELOPMENT Final Report, Oct. 1978 - Sep. 1979
James L. Brooks Apr. 1980 49 p refs
(ZR00001168)
(AD-A089299; CEL-TN-1575) Avail: NTIS HC A03/MF A01 CSCL 20/12

This report describes an effort made to determine the feasibility of developing a circuit using power semiconductor devices to duplicate the function of the power transformer. A circuit concept has been developed which duplicates the primary function of voltage stepup/stepdown but does not demonstrate the DC isolation characteristic of normal transformers. Several characteristics of the circuit appear very attractive, such as increased voltage regulation and relatively high efficiency. GRA

N81-10303# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
RADIATION EFFECTS ON THE MICROWAVE PROPERTIES OF GaAs MESFETS Final Technical Report, 1 Apr. 1978 - 30 Jun. 1979
Jose M. Borrego, Ronald J. Gutmann, Sanjay B. Moghe, and Kevin G. Rochford Griffiss AFB, N.Y. RADC Jun. 1980 71 p refs
(Contract F19628-78-C-0097; AF Proj. 2306)
(AD-A089410; RADC-TR-80-171) Avail: NTIS HC A04/MF A01 CSCL 09/1

The effect of fast neutron and gamma irradiation on the electrical characteristics of low noise microwave GaAs MESFET amplifiers has been evaluated. The microwave amplifiers were realized on alumina microstrip using commercial devices mounted in a common source configuration. The changes in the noise figure and amplifier gain at S- and X-band were determined for neutron fluences between 3 x 10 to the 12th power to 1 x 10 to the 15th power n/sq cm and for a gamma dose of 2 x 10 to the 7th power rads (Si). The noise figure starts to be affected at 10 to the 14th power n/sq cm and a large deterioration is observed at 1 x 10 to the 15th power n/sq cm. The increase in noise figure is related to the decrease in transconductance and increase in the parasitic source resistance. The decrease in the amplifier gain at the high neutron fluence is due to a deterioration of the transconductance, source resistance and

change in the gate to source and gate to drain capacitances. The low frequency noise increases with neutron radiation but not with gamma radiation. The low frequency noise appears not to be correlated with the microwave noise. Gamma irradiation increases the noise figure at a dose of 2 x 10 to the 7th power rads (Si) without affecting the signal characteristics of the device. It appears that gamma-radiation produces levels which respond at microwave frequencies. GRA

N81-10304# General Electric Co., Pittsfield, Mass. Ordnance Systems.

ELECTRICAL CHARACTERIZATION OF SPECIAL PURPOSE LINEAR MICROCIRCUITS Interim Report, Sep. 1978 - Sep. 1979

John S. Kulpinski, Theodore Simonsen, Louis Carrozza, Robert Mossman, and John Dunn Wright-Patterson AFB, Ohio RADC May 1980 378 p refs

(Contract F30602-78-C-0195; AF Proj. 2338)

(AD-A089422; RADC-TR-80-49) Avail: NTIS HC A17/MF A01 CSCL 09/5

This report covers the work performed by General Electric Ordnance Systems pertaining to the electrical characterization and specification of linear microcircuits. The period of report is August 1978 to December 1979. This technical report is divided into chapters covering specific device types with electrical characterization results. The following device types/families were characterized Adjustable Positive Voltage Regulators, Adjustable Negative Voltage Regulators. Precision B1 Fet Op Amps, Multiple B1 Fet Op Amps, 12 Bit A/D Converters, 12 Bit D/A Converters, Precision Voltage References, and Precision Sample/Hold Amplifiers. Data obtained during device characterization is published in handbook form obtainable under separate cover from this document. Samples of data sheets, histograms, and plots, are included in this report, however. GRA

N81-10305# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.

AN OPTOELECTRONIC DETECTOR WITH LINEAR GAIN FOR LIGHT MEASUREMENTS AND OPTICAL COMMUNICATION Final Report

Werner Spaeth, Wolfgang Soellner, and Guenter Waitl Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 64 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-86) Avail: NTIS HC A04/MF A01

Darlington amplifiers employing a current divider in a feedback circuit consisting of a combination of lateral and vertical transistors were developed. The realization of detector circuits with integrated amplifiers of this type is described. The cut-off frequency observed for units having a gain of about 200 was typically 7 MHz. Excellent gain linearity down to the pA-level makes these photodetectors particularly suitable for low level light detection. Author (ESA)

N81-10306# Technische Hochschule, Aachen (West Germany). Inst. fuer Theoretische Elektrotechnik.

AN ELECTRIC CROSSPOINT Final Report

Martin Willmann and Peter Zdebel Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 177 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-176) Avail: NTIS HC A09/MF A01

The development of an integrated crosspoint circuit for telephone switching applications in fully electronic exchange systems was studied. The progress made towards obtaining junction isolated thyristor switches of high quality and the extended study of functional logics have greatly facilitated the solution of the problems involved. The monolithic bipolar integration of an anlog space-division-multiplex switching network with a complex digital control-logic is described. It has excellent transmission properties. The circuit is manufactured using a bipolar technology 3 inch wafer. The technological aspects of the doping solutions as diffusion sources for buried layer and emitter diffusion are presented. Author (ESA)

N81-10307# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).

GaAs INTEGRATED CIRCUIT MATERIALS AND TECHNOLOGIES. PART 1: STUDY AND REALIZATION OF IMPLANTED EPITAXIAL LAYERS Final Report [ETUDE DE MATERIAUX ET DE TECHNOLOGIES POUR CIRCUITS INTEGRES A L'GAAS. PREMIER LOT: ETUDE ET ELABORATION DE COUCHES EPITAXIALES N(-1) IMPLANTEES]

Chantal Hurtes Jan. 1980 54 p refs In FRENCH

(Contract DGRST-78-7-2094)

(LEP-80/035.SME-441-K-Pt-1) Avail: NTIS HC A04/MF A01

Epitaxial n(-) layers for ionic implantation were prepared by the classical arsenic trichloride method using Ga and GaAs sources. Depositing temperatures in the 760 to 640 C range were employed. The O2 and Cr doping techniques adopted are described together with the different methods utilized to characterize defects: photoluminescence, DLTS and Hall measurements. Small dose Se(-) ion implantation was carried out at 280 KeV on both n layers and bulk semiconductor material. It was followed by classical annealing. Significant results are reported. Author (ESA)

N81-10308# European Space Agency, Paris (France).

DIGITAL PREFILTERING OF CORRELATED MEASUREMENT NOISE USING REGRESSION LINES

Rainer Froriep Jan. 1980 45 p refs Transl. into ENGLISH of "Digitale Vorfilterung bei Korrelierten Messstoerungen durch Ausgleichsgerade" Rept. DFVLR-Mitt-79-05 DFVLR, Oberpfaffenhofen, West Germany, May 1979 Original report in GERMAN previously announced as N80-17059

(ESA-TT-604; DFVLR-Mitt-79-05) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 10.80

The fast initial fine alignment of an inertial platform with a Kalman filter accelerated by a digital prefilter is shown. The digital prefilter is used to estimate certain state variables by constructing linear mean square regression lines from each batch of measurements with colored noise. The developed prefilter is characterized by a brief computation time and small storage requirements, which makes a very high data rate possible. The choice of filter structure and parameters is discussed referring to simulation results. The filter algorithm is illustrated step by step, both on line and off line. It is compared to prefiltering by averaging and is shown to perform well. Author (ESA)

N81-10309# National Technical Information Service, Springfield, Va.

FERRITE MICROWAVE ELECTRONICS CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1976 - Jun. 1980

William E. Reed Jul. 1980 90 p Supersedes NTIS/PS-79/0763: NTIS/PS-78/0738

(PB80-812662; NTIS/PS-79/0763; NTIS/PS-78/0738) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

Research reports on single crystals, thin films, dielectrics, semiconductor devices, integrated circuits, phase shifters, and waveguide components are cited. Studies on the microwave properties of ferrites are included. GRA

N81-10220# Joint Publications Research Service, Arlington, Va.

ADVANTAGES, PRACTICAL USES OF WATER-INSULATED CABLE

In its West Europe Rept.: Sci. and Technol., No. 13 (JPRS-75031) 30 Jan. 1980 p 1-11 Transl. into ENGLISH from Energie (Graefelfing, West Germany), no. 10, Oct. 1979 p 334-337 (For primary document see N81-10219 01-31)

Avail: NTIS HC A03/MF A01

N81-10221# Joint Publications Research Service, Arlington, Va.

DEVELOPMENT, MANUFACTURE OF GAS-INSULATED CABLE

Eng Eckhard Abilgaard *In its* West Europe Rept.: Sci. and Technol., No. 13 (JPRS-75031) 30 Jan. 1980 p 12-31 refs Transl. into ENGLISH from Energie (Graefelfing, West Germany), no. 10, Oct. 1979 p 328-333 (For primary document see N81-10219 01-31)

Avail: NTIS HC A03/MF A01

N81-10228# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF MULTILAYER CONDUCTORS DISCUSSED
C. Val *In its* West Europe Rept.: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 40-62 refs Transl. into ENGLISH from Rev. Tech. Thomson-CSF (France), no. 2, Jan. 1979 p 259-260 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N81-10310 Tennessee Univ., Knoxville.
NUMERICAL SOLUTION OF ATMOSPHERIC FLOW OVER SEMIELLIPTICAL SIMULATED HILLS Ph.D. Thesis
Chih-Fang Shieh 1980 134 p
Avail: Univ. Microfilms Order No. 8024932

The partial differential equations for the vorticity, stream function, turbulence kinetic energy, and turbulence length scale were solved by a finite difference technique. The numerical solutions were compared with available experimental data. It was found that the mechanism of flow separation induced by a semiellipse was the same as in the case of flow over a gradually sloping surface. For flow over bluff bodies, e.g., solid fences, a large downstream recirculation bubble was created due to the inability of the flow to negotiate with the abrupt change of the surface shape. Increasing the aspect ratio and/or increasing the turbulence level resulted in flow reattachment close behind the obstacle. Dissert. Abstr.

N81-10311 Washington Univ., St. Louis, Mo.
THE EFFECT OF EVAPORATIVE VAPOR RECOIL ON THE INSTABILITY OF LIQUID JETS Ph.D. Thesis
Scott Frank Emory 1980 128 p
Avail: Univ. Microfilms Order No. 8026228

The stability of cylindrical liquid jets undergoing evaporation is examined theoretically with a linear analysis. Predictions of the effects on jet length of Marangoni flow and the differential recoil force exerted on the liquid surface by evaporating molecules are obtained for a laminar viscous jet in inviscid surroundings. These predictions indicate that evaporation may have an important stabilizing influence which elongates the jet in those situations where breakup occurs prior to any significant evaporative tapering. The results of experimental work conducted as part of this investigation indicate that linear analysis overpredicts this stabilizing influence. In those experiments where a moderate increase (less than 50%) in the jet length was predicted none was observed, and the extremes of evaporation rate and high vacuum necessary for the much larger predicted increases were found to be outside the range of the experimental method used. It is proposed that a nonlinear, large amplitude analysis would be necessary to obtain more accurate quantitative predictions. Dissert. Abstr.

N81-10312 Wisconsin Univ. - Madison.
AN EXPERIMENTAL AND NUMERICAL STUDY OF NATURAL CONVECTIVE HEAT TRANSFER; IN MODERATE ASPECT RATIO AND VEE-GROOVE ENCLOSURES Ph.D. Thesis
Brad Anthony Meyer 1980 212 p
Avail: Univ. Microfilms Order No. 8018130

Interferometric and finite difference/finite element techniques were used to determine the heat transfer coefficients for natural convection in slat and vee-groove (trough) type enclosures. For the slat enclosure the effects of Rayleigh number, tilt and slat angle, aspect ratio, cell wall thickness and wall conductivity on the Nusselt number were determined. Results indicate that the convective heat transfer is a strong function of the aspect ratio for aspect ratios less than 4. For aspect ratios in the range of 0.5 to 4, spacers between the plates increase, rather than decrease, natural convection heat transfer compared to that for long enclosures. Slat angles less than 90 deg reduce convective heat transfer. Convection coefficients for cells with adiabatic walls are substantially higher than those with conducting walls. The effects of Rayleigh number, tilt angle, and ideal concentration ratio on the Nusselt number were determined for the vee-groove (trough) enclosure. The results show that convective losses for conventional flat plate and trough collectors are approximately equivalent for coefficient convection = 2 and that losses for coefficient of convection = 3 are about 15% less than coefficient of convection = 2. Dissert. Abstr.

N81-10313 Washington State Univ., Pullman.
SCALING LAWS FOR METERING THE FLOWS OF GAS-PARTICLE SUSPENSIONS THROUGH VENTURIS Ph.D. Thesis
Jaesoo Lee 1980 174 p
Avail: Univ. Microfilms Order No. 8025934

The pressure drop across standard ASME venturis with gas-particle flow was measured for differing particle/gas loadings, Stokes numbers, Beta-ratios, meter orientations, meter geometries and particle types. It was found that Stokes number and loading ratio are the two most important parameters controlling pressure drop of gas-particle flows in a venturi. The results show that pressure drop increases linearly with loading ratio and decreases monotonically with increasing Stokes number. The results also indicate that beta-ratio and orientation of the venturi do not significantly affect the pressure drop. Data for irregularly shaped pulverized coal particles show a higher pressure drop compared with that for spherical particles. The abrupt change of the upstream geometry of flow nozzle increases the pressure drop above that for a venturi. The predicitons of a quasi one-dimensional numerical model were compared with the experimental results. The model consistently predicts a higher pressure drop than measured. Dissert. Abstr.

N81-10314 Polytechnic Inst. of New York.
FREE STREAMLINE FLOWS WITH SURFACE TENSION EFFECTS Ph.D. Thesis
Ta-Jo Liu 1980 166 p
Avail: Univ. Microfilms Order No. 8019404

The effect of surface tension on the fluid motion of a two dimensional high speed liquid jet issuing from a slot is analyzed. To solve the mathematical problem, which is characterized by a nonlinear boundary condition on the free streamline, a numerical technique based on the odd-even cyclic reduction method was developed. This technique is superior to the conventional iterative methods in the sense that only the unknowns on the nonlinear boundary line are involved in the iteration rather than all the interior points. After convergence is achieved, the remaining unknowns are determined directly. The numerical technique was applied to the slot problem, and the numerical solutions corresponding to cases of a small surface tension coefficient were found. Dissert. Abstr.

N81-10315 Michigan Univ., Ann Arbor.
SOLUTIONS IN THE LARGE FOR SOME NONLINEAR HYPERBOLIC CONSERVATION LAWS OF GAS DYNAMICS Ph.D. Thesis
John Blake Temple 1980 114 p
Avail: Univ. Microfilms Order No. 8025783

The constraints under which a gas at a certain state will evolve can be given by three partial differential equations which express the conservation of mass, momentum, and energy. A particular energy function was discovered for which there is a global weak solution for bounded measurable data having finite total variation. This energy function models an ideal gas, and is given by the formula e = - lambda eta V + (S/R). The following general existence theorem is also obtained: let e sub epsilon (v,S) be any smooth one parameter family of energy functions such that at epsilon = 0 the energy is given by e (v,S) = - lambda eta V + (S/R). It is proven that there exists a constant C independent of epsilon, such that, if the total variation of the inertial data < C, then there exists a global weak solution to the equations. An existence theorem for polytropic gases was also obtained. Dissert. Abstr.

N81-10316 Arkansas Univ., Fayetteville.
MEASUREMENT OF VOID FRACTION BY FAST NEUTRONS Ph.D. Thesis
Mahmoud Reza Ghavi 1980 138 p
Avail: Univ. Microfilms Order No. 8026019

The feasibility of using fast neutron moderation and scattering, and attenuation as means for measurement of void fraction in hydrogenous two phase flow was studied. Various geometries and different size channels were tested to examine the adaptability of the method to different arrangements. Experiments with static and dynamic voids were performed. For static tests, two phase air-water mixtures were simulated using various size plexiglass mock-ups in cylindrical channels. In dynamic experiments, the neutron techniques were tested in actual air water mixtures using different size cylindrical channels. A small californium 252 source was used as the source of neutrons. The proposed techniques for measurement of void fraction in hydrogenous two phase mixtures proved suitable. The feasibility of utilization of a small CF-252 neutron source for void fraction measurements was demonstrated as the neutron flux provided by the small source used in this study proved to be adequate. Dissert. Abstr.

N81-10317 Illinois Inst. of Tech., Chicago.
PERFORMANCE PREDICTIONS OF SILICA GEL DESICCANT COOLING SYSTEMS Ph.D. Thesis
Balakrishnan Mathiprakasam 1980 206 p
Avail: Univ. Microfilms Order No. 8026152

The cross cooled dehumidifier which is the principal component of the present system is modeled. The model leads to a system of nonlinear coupled heat and mass transfer equations for the sorption processes and linear heat transfer equations for the purging processes. The model accounts for the gas film resistance and for the moisture diffusion in the desiccant. The governing equations are solved by a finite difference scheme to obtain periodic steady state solutions. The accuracy of the theoretical predictions is ascertained by comparing them with the experimental results. The performance of the complete cooling system (with all the components) was simulated and several results were obtained for a wide range of system parameters and operating conditions. It was shown that simple flat plate collectors can provide the necessary heat for the system. Simple linear solutions were obtained for the case of adiabatic desiccant dehumidifiers. Dissert. Abstr.

N81-10318 Pennsylvania State Univ., University Park.
COHERENT ANTI-STOKES RAMAN SCATTERING FROM SIMPLE FLUIDS Ph.D. Thesis
Charles Michael Roland 1980 130 p
Avail: Univ. Microfilms Order No. 8024486

Measurements of vibration and rotation CARS spectra are reported for several liquids and vapors. Calculations of the observed bandshapes were carried out and forms for vibrational and orientational correlation functions extracted from the data. The effect of the electronic susceptibility on polarized spectra of the v sub 2 Fermi resonant bending mode in liquid carbon tetrachloride was investigated. The CARS spectra of the v sub 3 symmetric stretch in liquid methyl iodide were obtained. Correlation times for the polarized and the depolarized spectra are reported, along with estimates of the third order electronic susceptibility. The CARS Q branch of N2 was measured as a function of the gas density. An approach for obtaining low frequency CARS spectra is described. Applicable to any Raman mode involving an anisotropy in the polarizability, the method was used to obtain the pure rotational spectrum of atmospheric N2 and O2. Polarized and depolarized spectra were measured for the v sub 1 symmetric stretch in carbon dioxide at a series of densities. The frequency shift coefficient and vibrational collision cross section obtained from the polarized band widths are used to estimate the magnitude of the phase shifts introduced into the vibration by collisions. Dissert. Abstr.

N81-10319 Maryland Univ., College Park.
THE RAPID DEPRESSURIZATION OF INITIALLY SATURATED FLUIDS FROM PRESSURE VESSELS Ph.D. Thesis
Robert Edward Fishman 1980 205 p
Avail: Univ. Microfilms Order No. 8025263

Nonequilibrium effects during rapid depressurizations include large initial pressure fluctuations, a separated flow pattern consisting of a superheated vapor region above a two phase boiling froth, a significant temperature gradient in the vapor zone and entrained liquid droplets in the effluent stream. The physical basis for the nonequilibrium behavior was examined. A model which predicts these phenomena as well as the pressure time relationship for depressurizing vessels containing boiling fluids is described. The submodels include: (1) a Second Law 'tracer' which analyzes the thermodynamic process followed by an open, depressurizing system; (2) a correlation predicting the wall superheat required to support nucleation during rapid depressurizations; (3) a correlation establishing the relationship between the exit mass flow rate and the void fraction in the boiling region; (4) an analysis which predicts droplet entrainment by vapor bubbles rising in a boiling froth; and (5) an analysis which predicts the initial transient behavior. The results of the model were compared with Freon-12 depressurization experiments utilizing small pressure vessels. Dissert. Abstr.

N81-10320 Michigan Univ., Ann Arbor.
FORCE SINGULARITIES IN TWO-DIMENSIONAL FLOWS Ph.D. Thesis
Josue Njock-Libil 1980 176 p
Avail: Univ. Microfilms Order No. 8025737

The effects of force singularities in two dimensional flows at low Reynolds numbers are investigated for both homogeneous and stratified fluids. The method of solution is based on Green's functions. The Navier-Stokes equations are linearized using Oseen's approximation and Boussinesq's approximation is used to describe the influence of density. Force singularities are introduced by means of Dirac's delta functions. The resulting system of equations is solved after introducing the stream function to yield fundamental solutions. These fundamental solutions are general and can be made to satisfy given boundary conditions. This process is illustrated by considering uniform flow in the infinite domain as well as flow between two moving parallel plates. The usefulneess of the fundamental solutions obtained is demonstrated in the case of uniform flow in the infinite domain. Homogeneous fluids are obtained as a special case of stratified fluids. When the fluid is stratified, flow patterns associated with force singularities reveal an infinite series of vortex cells. A summary of two dimensional singularities is presented in the form of a table. Force singularities in stratified fluids are added to the table. Dissert. Abstr.

N81-10321 Michigan Univ., Ann Arbor.
LAMINAR FLOW SEPARATION FROM STREAMLINED BODIES AT HIGH REYNOLDS NUMBER Ph.D. Thesis
John Phillip Hackett 1980 137 p
Avail: Univ. Microfilms Order No. 8025691

High Reynolds number steady laminar flow separation on nonlifting streamlined bodies was investigated by adopting an iteration scheme using the velocity-vorticity formulation. The Helmholtz vorticity equation is solved with its velocity coefficients presumed known from the previous iteration. The formulation is evaluated in two dimensions by application to a flat plate and to a thin body. For these applications the second approximation equations are simplified through order of magnetitude analysis; analytic solutions for the second approximation result. A third approximation is evaluated in both of the two dimensional applications. The third approximation results show improvements over the second approximation results. Dissert. Abstr.

N81-10322*# Old Dominion Univ., Norfolk, Va. Dept. of Oceanography.
FREE-STREAM DISTURBANCE, CONTINUOUS EIGENFUNCTIONS, BOUNDARY-LAYER INSTABILITY AND TRANSITION Final Report, 16 May 1979 - 15 Sep. 1980
Chester E. Grosch Sep. 1980 92 p refs
(Contract NsG-1618)
(NASA-CR-163669) Avail: NTIS HC A05/MF A01 CSCL 20D

A rational foundation is presented for the application of the linear shear flows to transition prediction, and an explicit method is given for carrying out the necessary calculations. The expansions used are shown to be complete. Sample calculations show that a typical boundary layer is very sensitive to vorticity disturbances in the inner boundary layer, near the critical layer. Vorticity disturbances three or four boundary layer thicknesses above the

boundary are nearly uncoupled from the boundary layer in that the amplitudes of the discrete Tollmien-Schlicting waves are an extremely small fraction of the amplitude of the disturbance.
A.R.H.

N81-10323# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.
FLUID TRANSPORT INTO CRAZES UNDER TRIAXIAL STRESS
Abdelsamie Moet and Eric Baer 25 Aug. 1980 33 p refs
(Contract N00014-75-C-0795)
(AD-A089193; TR-11) Avail: NTIS HC A03/MF A01 CSCL 20/4

The penetration coefficient of silicon oil (500 cS) into PS during tensile deformation was determined under a range of superposed hydrostatic pressure of 1 to 1200 bars. At atmospheric pressure, the liquid front, driven by a relatively high capillary pressure, was found to lag behind the 'dry' craze tip front. The penetrability was observed to increase as a steep linear function of the pressure up to 80 bars at which the liquid front was forced to reach the craze tip front. At higher pressures, a stage of suppressed penetrability was observed which was associated with a substantial decrease in the craze size and density. The suppressed penetrability is explained on the basis of pressure induced 'void' reduction competing with its pumping component. An effective axial strain analysis is presented to explain such a reduction. The effect of pressure on the maximum stress at the tip of a flaw, in conjunction with the distribution of surface defects, is found to account for the suppressed craze density at elevated pressures.
GRA

N81-10324# Naval Ocean Systems Center, San Diego, Calif.
IMPLEMENTATION AND EVALUATION OF THE DISTURBANCE AMPLIFICATION IN BOUNDARY LAYERS (DABL) COMPUTER PROGRAM. A USER'S MANUAL
T. S. Mautner Mar. 1980 52 p refs
(AD-A089443; NOSC/TD-340) Avail: NTIS HC A04/MF A01 CSCL 20/4

The implementation and evaluation of the FORTRAN 4 computer program DABL (Disturbance Amplification in Boundary Layers) is described. The program calculates the growth of small disturbances in laminar boundary layers.
E.D.K.

N81-10325# Purdue Univ., Hammond, Ind.
QUASISTEADY VISCOUS FLOWS Final Report, 1 Jan. - 31 Jul. 1980
Paul Gordon 31 Jul. 1980 68 p refs
(Contract N00014-78-C-0308)
(AD-A088602) Avail: NTIS HC A04/MF A01 CSCL 20/4

Quasisteady analysis is applied to time dependent viscous flows. The basic model consists of Cauchy's equations in which relaxation equations are used to model the viscous parameters. Quasisteady models are obtained for the one and two dimensional cases, and specific application is made to both compressible and incompressible boundary layer situations. Several analytical and numerical solutions are obtained for the incompressible models.
M.G.

N81-10326# Wisconsin Univ. - Madison.
NONLINEAR VOLTERRA EQUATIONS FOR HEAT FLOW IN MATERIALS WITH MEMORY Summary Report
John A. Nohel May 1980 97 p
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A089634; MRC-TSR-2081) Avail: NTIS HC A05/MF A01 CSCL 20/13

The nonlinear Volterra equation $u(t)+(b*Au)(t)$ not an element of f(t) is considered. Existing and recent results are discussed for the following problems: (1) the global existence and uniqueness of solutions and their continuous dependence on the data; (2) the boundedness and asymptotic behavior as it approaches infinity in the special cases where X = H is a real Hilbert space and A is either a maximum monotone operator on H, or A is a subdifferential of a proper, convex, lower semicontinuum function; and (3) the existence, boundedness, and asymptotic behavior of positive solutions in the general setting. The theory is used to study one possible model problem for heat flow in a material with memory which can be transformed to the equivalent form under physically reasonable assumptions. This and other models for heat flow in such materials are formulated from physical principals and discussed.
GRA

N81-10327# Operations Research, Inc., Silver Spring, Md.
EFFECTS OF SHEAR ON VORTEX SHEDDING PATTERNS IN HIGH REYNOLDS NUMBER FLOW: AN EXPERIMENTAL STUDY
[1980] 71 p refs
(Contract EG-77-A-29-1078)
(DOE/NOAA/OTEC-9) Avail: NTIS HC A04/MF A01

The effects of current shear on vortex shedding patterns in high Reynolds number (R/sub e/) flow around a circular cylinder used to model the OTEC CWP are addressed. Tests were conducted in a wind tunnel on a 56-inch long, 6-inch diameter circular cylinder for various flow and shear conditions. Measurements were conducted to describe the frequencies of the eddies shed from the cylinder and to investigate the fluctuation surface pressure on the cylinder. From these tests it was determined that shedding for high R/sub e/ sheared flow is characterized by the formation of distinct cells of eddies with constant frequency, that pressure fluctuations on the surface of the cylinder are greater for sheared flow than unsheared flow, and that the mean surface pressures are generally independent of the magnitude of shear.
DOE

N81-10328# California Univ., Livermore. Lawrence Livermore Lab.
ACCURACY OF VARIOUS ALTERNATE METHODS OF CALCULATING TOTAL MASS FLOW RATE FOR PKL INSTRUMENTED PIPE SPOOL PROTOTYPE TESTS IN SINGLE- AND TWO-PHASE STEAM-WATER FLOWS
W. Stein Dec. 1979 24 p refs
(Contract W-7405-eng-48)
(UCRL-52965) Avail: NTIS HC A02/MF A01

Instrumented spool pieces for installation in the piping of the German Primarkreislauf (PKL) test reactor were designed and tested. The primary objective of the spools is to provide measurements of two phase stream water flow parameters (pressure, temperature, velocity) from which mass flow rates can be calculated. Each spool contains a three beam densitometer, flow turbine, drag screen, and pressure and temperature sensors. The spools were prototype tested in single and two phase steam water flows and the results of the mass flow calculations were compared to known values. The present software calculations of total mass flow in two phase flows requires data from two instruments only; the flow turbine and drag screen. In this report, mass flow calculations based on other instrument combinations are investigated and compared to the programmed calculations.
DOE

N81-10329# Atomic Weapons Research Establishment, Aldermaston (England).
THE FOULNESS MULTITON AIR BLAST SIMULATOR. PART 3: BLAST WAVE FORMATION AND METHODS USED TO DRIVE THE SIMULATOR
Pamela M. Clare London Mar. 1980 34 p refs
(AWRE-O-3/80-Pt-3; BR73202; ISBN-0-85518-137-8) Avail: NTIS HC A03/MF A01; HMSO £1.50 PHI

The mechanisms by which blast waves are generated by a helical charge of detonating fuse in a 4.9 m diameter nuclear air blast simulator were studied in order to achieve control over the waveform produced. The problem of producing low pressure blast waves with long duration was overcome by immersing the charge in an aqueous foam in the firing chamber. A comparison is made with pressure-time profiles of a 1 kton nuclear shot, concluding that an accurate simulation involves a combination of techniques rather than the simple firing of an axially placed charge.
Author (ESA)

N81-10330# Cambridge Univ. (England). Dept. of Engineering.
THE BOUNDARY LAYER DEVELOPMENT DOWNSTREAM OF A SHOCK INTERACTION AT AN EXPANSION CORNER
Y. T. Chew and L. C. Squire London Aug. 1979 48 p refs Supersedes ARC-37863
(ARC-R/M-3839; BR73039; ARC-37863;
ISBN-0-11-471172-0) Avail: NTIS HC A03/MF A01; HMSO £9 PHI

Boundary layer developments were measured for flow downstream of an expansion corner when the boundary layer is disturbed by a shock wave striking the surface near the corner. It was found that most velocity profiles quickly relax to a near equilibrium state in about 8 to 16 boundary layer thicknesses with the distance depending on the shock strength. The boundary layer developments are in fair agreement with the predictions from an eddy-viscosity model when the incident shock is weak. For stronger shocks the calculated profiles from the eddy-viscosity model and from Bradshaw's turbulent energy method are similar, but both fail to predict the measured boundary layer development. However, the agreement was much improved if the calculation was started from the first measured profile after the shock interaction, and the prediction from the eddy-viscosity model was further improved if an exponential lag equation was used to account for the transport properties of the turbulence. Author (ESA)

N81-10331# National Engineering Lab., East Kilbride (Scotland). Flow Measurement Div.

FLOW MEASUREMENT FACILITIES AT THE NATIONAL ENGINEERING LABORATORY ON OCTOBER 1, 1979

Oct. 1979 36 p refs

(NEL-665) Avail: NTIS HC A03/MF A01

Measurement facilities using water, oil, air, special fluids, and two phase mixtures are described. Water flow rates up to 1.5 cu m/sec are available. Flowmeters with bore diameters between 12 mm and 760 mm can be tested. Oil flow rates up to 90 l/sec can be measured at viscosities between 5 cSt and 25 cSt at 20 C, and 3 cSt to 40 cSt at other temperatures. Air and gas flow measurements can be made at flowrates between 0.005 cu m/sec and 10.000 cu m/sec. Higher rates are measured by pitot traversing in wind tunnels. Compressed air can be measured in a pressure range 2 bars to 50 bars and flowrates in the range 0.02 kg/sec to 4 kg/sec. Equipment is available for studying the flow of air/water, oil/air, and oil/water mixtures. Author (ESA)

N81-10332# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

PROPAGATION OF FINITE-AMPLITUDE WAVES IN A NEARLY PARALLEL FLOW

Geert Zimmermann Nov. 1979 20 p refs

(MPIS-21/1979; ISSN-0436-1199) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 6

The equations governing the long range propagation of two dimensional nonlinear disturbance waves in a boundary layer are derived assuming that the boundary layer thickness and the wavelength are of the same order of magnitude and that the Reynolds number is large. A multiple scales method is used with the Reynolds number as an expansion parameter. The resulting equations constitute a spatial initial boundary value problem which can be numerically solved. Author (ESA)

N81-10333# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.

RADIAL PUMP IMPELLER MEASUREMENTS USING A LASER DOPPLER VELOCIMETER

H. Kannemans Sep. 1979 10 p refs Presented at ASME Gas Turbine Conf. and Products Show, New Orleans, 9-13 Mar. 1980 Submitted for publication

(VKI-Preprint-1979-17) Avail: NTIS HC A02/MF A01

A shrouded fully transparent radial pump impeller with thin backswept blades was tested using a laser Doppler velocimeter. Two components of the velocity were measured relative to the laboratory reference frame in a plane perpendicular to the axis of rotation. The velocity distribution is presented relative to the blades at different radii and different flow rates over the whole blade passage. Results show that the flow is essentially unsteady and, at low flow rate, highly influenced by viscous effects. A comparison between the experimental data and a potential flow theory shows good agreement at high flow rates. Author (ESA)

N81-10334# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.

INFLUENCE OF MACH NUMBER AND END WALL COOLING ON SECONDARY FLOWS IN A STRAIGHT NOZZLE CASCADE

C. H. Sieverding and P. Wilputte 1979 10 p refs Presented at ASME Gas Turbine Conf. and Products Show, New Orleans, 9-13 Mar. 1980 Submitted for publication

(Grant DA-ERO-75-G-074)

(VKI-Preprint-1980-2) Avail: NTIS HC A02/MF A01

The effect of Mach number and end wall cooling on the secondary flow in a straight nozzle cascade with an aspect ratio of h/c = 0.83 was studied. The tests were performed for outlet Mach numbers M2 = 0.1, 0.6 and 0.8. The cooling tests were done for one specific cooling configuration consisting of three double rows of injection holes positioned at the leading edge, inside the blade passage, and in the throat. The flow was injected into the direction of the free stream direction. The tests were carried out for two cooling mass flow ratios: m dot/m dot sub tot = 0.02 and 0.045. The corresponding injection to main flow pressure ratios were: 1.0, 1.16 for m sub 2 = 0.6 and 1.0, and 1.26 for m sub 2 = 0.8. The flow surveys were made with three dimensional pressure probes. Author (ESA)

N81-10335# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Environmental and Applied Fluid Dynamics Dept.

A KINETIC MODEL FOR A GAS-PARTICLE FLOW

R. BurmesterdeBessaRibas, L. Lourenco, and M. L. Riethmuller Dec. 1979 18 p refs Presented at Pneumotransport 5, Apr. 1980 Submitted for publication

(VKI-Preprint-1980-4) Avail: NTIS HC A02/MF A01

A model for gas particle flows is proposed which is applicable to pneumatic transport of relatively dilute suspensions with large particles. A theoretical prediction of particle density profiles is formulated, as well as length scales and non dimensional parameters. Histograms of particle velocity components and associated statistical quantities are measured. Traverses of particle mean horizontal components and of root mean square values of horizontal and vertical velocity components are also carried out, as well as of density profiles. The comparison between theoretical prediction and experimental results is satisfactory. Author (ESA)

N81-10336# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Environmental and Applied Fluid Dynamics Dept.

PARTICLE NUMBER DENSITY MEASUREMENT IN A GAS-SOLID PARTICLE FLOW

L. Lourenco and M. L. Riethmuller Dec. 1979 10 p refs Presented at Pneumotransport 5, Apr. 1980 Submitted for publication

(VKI-PREPRINT-1980-5) Avail: NTIS HC A02/MF A01

A digital method for the measurement of the particle density in a gas-solid flowing suspension was developed. The method consists of counting the number of particles which cross a control surface per unit time. The control surface is formed by a laser beam. It is shown that the number of particles crossing the control surface per unit time is related to the particle density and velocity within the limits of linearity of the method. A simple procedure is presented to determine this limit of linearity. This method was applied to particle density in a gas particle flow, and is shown to be a good complement to an analog method. Author (ESA)

N81-10337# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.

ON THE PREDICTION OF THE REVERSE FLOW ONSET AT THE CENTRIFUGAL PUMP INLET

B. Schiavello (Worthington Nord S.p.A.) and M. Sen 1980 14 p refs Presented at ASME Symp. on Performance Prediction of Centrifugal Pumps and Compressors, New Orleans, 1980 Submitted for publication

(VKI-Preprint-1980-6; TN-81) Avail: NTIS HC A02/MF A01

Several models of centrifugal pump impellers were designed and tested in order to find design criteria for minimum reverse flow capacity and wide pump operating range. Aerodynamic pressure field, meridional flow diffusion and secondary flows were assumed as prevailing factors on flow separation and reverse flow onset in impellers of low specific speed centrifugal pumps. Overall and detailed time steady measurements at the impeller inlet and exit are discussed. Analysis of the results shows that

the delay of the flow separation reverse flow prerotation phenomena, which are occurring in sequence, is strictly linked to the relative flow diffusion in the impeller tip streamtube and to the blade spanwise aerodynamic loading distribution. Some criteria for predicting the reverse flow onset are presented.
Author (ESA)

N81-10338# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
OPTICAL MEASUREMENTS OF THE DIFFUSION OF A HEAVY GAS IN TURBULENT BOUNDARY LAYERS
C. Borrego and M. L. Riethmuller 1980 23 p refs Presented at Von Karman Inst. Lecture Ser. on Meas. and Predictions of Complex Turbulent Flow, Rhode-Saint-Genese, Belgium, 11-15 Feb. 1980 Submitted for publication
(VKI-Preprint-1980-9) Avail: NTIS HC A02/MF A01

Wind tunnel studies of the release of a heavy gas into the atmosphere at ground level were conducted using laser Doppler velocimetry and a laser scatter system for concentration measurements. A comparison with more conventional concentration measuring techniques allowed the validation of both methods. The correlations between velocity and concentration show that the three regions in which the flow should be interpreted in a completely different manner. Author (ESA)

N81-10339# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
TURBULENT JETS AND WAKES AND SEMI-ANALYTIC CALCULATIONS FOR THE WEAK FLOWS Final Report
D. A. Humphreys 1979 66 p refs
(Contract FMV-F-ink-82223-74-001-07-001)
(FFA-TN-AU-1196) Avail: NTIS HC A04/MF A01

From knowledge of the orders of magnitude of the individual terms occurring in the full equations of motion, various approximate sets of equations can be derived. For weak jets and wakes the lowest order mean longitudinal momentum equation reduces to only two terms. The effects of some of the remaining small terms were investigated one by one with a semianalytic procedure, relying on the order of magnitude separation between terms. In the applications presented, an additional assumption is made that the perturbing terms are slowly varying functions of downstream location. The effects allowed for are nonlinear convection, Reynolds normal stress, intermittency, and particulate contamination. Author (ESA)

N81-10340# New England Research Application Center, Storrs, Conn.
ADIABATIC GAS FLOW. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1964 - Apr. 1980
Robert Hippler May 1980 88 p Sponsored in part by NTIS
(PB80-808553) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

This bibliography covers worldwide literature on adiabatic gas flows for planetary and stellar atmospheres, aerodynamic, heat transfer, nozzles, turbines, and energy systems, such as MHD and fusion reactors. Eighty-three citations cover analytical and modeling techniques, characteristics, experimental data, and fundamental principles. Two and three dimensional, compressible and incompressible gas dynamic flows, for unbounded and bounded, stable and unstable conditions are also covered. GRA

N81-10341# Arizona State Univ., Tempe. Engineering Research Center.
LAMINAR FILM FLOW PHENOMENA: THEORY AND APPLICATION TO THE TWO PHASE CLOSED THERMOSYPHON Final Report
R. T. Hirshburg and L. W. Florschuetz May 1980 344 p refs
(Grant NSF ENG-75-09072)
(PB80-205156; ERC-R-80020) Avail: NTIS HC A15/MF A01 CSCL 20D

A theoretical model is developed to predict the hydrodynamic features of asymptotic wavy flow states. The model accurately predicts published experimental data for mean film thickness, trough-to-crest dimension, wave celerity, and wavelength. The Nusselt theory for laminar film condensation is shown to significantly under-predict existing experimental data due to the presence of waves on the condensate film surface. A heat transfer model is developed incorporating the wavy film hydrodynamic model results. Other thin film phenomena are described, including continuous film breakdown, rivulet flow, and sputtering. All of these phenomena are present in the operation of a heat transfer device. GRA

N81-10342# Arizona State Univ., Tempe. Dept. of Mechanical and Energy Systems Engineering.
HEAT TRANSFER CHARACTERISTICS OF THE TWO-PHASE CLOSED THERMOSYPHON (WICKLESS HEAT PIPE) INCLUDING DIRECT FLOW OBSERVATION Final Report
F. E. Andros and L. W. Florschuetz Apr. 1980 367 p refs
(Grant NSF ENG-75-09072)
(PB80-203540; ERC-R-80019) Avail: NTIS HC A16/MF A01 CSCL 20D

A visual study of an annular two phase closed thermosyphon is reported. For small and intermediate liquid fill quantities, four flow regimes were observed in the evaporation section, in addition to nucleate boiling in the liquid pool: (1) a smooth continuous film with surface evaporation; (2) breakdown of the film into stable rivulets; (3) a wavy film with unstable rivulets; and (4) a wavy film with bubble nucleation in the unstable rivulets. Three different types of dry-out conditions were also observed and are reported in detail. Results obtained for a stainless steel tubular opaque device with Freon-113 as a working fluid are reported. Both steady state heat transfer characteristics and heat transfer limits are reported in detail. Results from the visual and opaque devices are compared and discussed. GRA

N81-10922# Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie.
RECENT TEMPERATURE AND WAVE PROPAGATION RESULTS BETWEEN 30 AND 100 KM OBTAINED BY LIDAR TECHNIQUES
M. L. Chanin, A. Hauchecorne, and P. Juramy *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 45-48 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10998# Joint Publications Research Service, Arlington, Va.
FEASIBILITY OF LONG-RANGE HEAT TRANSFER EXAMINED
E. Windorfer *In its* West Europe Rept.: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 50-57 refs Transl. into ENGLISH from Brennstoff-Waerme Kraft (Duesseldorf), Aug. 1979 p 334-336 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-10343 Minnesota Univ., Minneapolis.
DATA REDUCTION TECHNIQUES FOR AEROSOL SIZE DISTRIBUTION MEASURING INSTRUMENTS Ph.D. Thesis
Abdemannan Zakiuddia Kapadia 1980 294 p
Avail: Univ. Microfilms Order No. 8025464

Data reduction methods for the electrical aerosol analyzer (EAA) and the diffusion battery condensation nuclei counter (DB-CNC) are presented. Both the EAA and DB-CNC can be modeled by the Fredholm integral equation of the first kind. Thus the data reduction methods for both the instruments are similar. The data reduction methods for both the instruments were analyzed with simulated and experimental data. For the EAA, the comparison between the different data reduction methods for the number of distribution is excellent, however, for the surface and volume distributions, the agreement was

only satisfactory in the size range of 0.316 to 1.0 micron m. The agreement between the number distribution retrieved by the three data reduction methods for the DB-CNC was found to be good. Also, between different diffusion battery measurements for the same aerosol, the geometric number mean diameters (DGN) determined by the simplex minimization curve fitting procedure agree satisfactorily. However, the agreement in the various estimates of the geometric standard deviation becomes unsatisfactory as the DGN increases. Dissert. Abstr.

N81-10344*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ELECTRICAL TORQUES ON THE ELECTROSTATIC GYRO IN THE GYRO RELATIVITY EXPERIMENT

Peter Eby and Wesley Darbo Oct. 1980 66 p refs

(NASA-TM-78311) Avail: NTIS HC A04/MF A01 CSCL 14B

A comprehensive discussion and calculation of electrical torques on an electrostatic gyro as they relate to the gyroscope experiment to test general relativity is presented. Drift rates were computed for some typical state of the art rotors, including higher harmonics in the rotor shape. The effect of orbital averaging of gravity gradient forces, roll averaging of torques, and the effect of spin averaging on the effective shape of the rotor were considered. The electrical torques are reduced sufficiently in a low g environment to permit a measurement of the relativistic drifts predicted by general relativity. T.M.

N81-10345# New Mexico State Univ., Las Cruces. Electrical and Computer Engineering.

EXPERIMENTAL MEASUREMENT TECHNIQUES Final Report

Stuart A. Schleusener Aug. 1980 72 p refs

(Grant DAAG29-76-G-0165)

(AD-A089221; ARO-13685.2-GSX) Avail: NTIS HC A04/MF A01 CSCL 14/2

A pellet spectrophone has been designed and constructed to measure low level absorption by atmospheric dust and other particulate matter. It was shown that an absorption to scattering sensitivity greater than 50 can be achieved, which is a necessary property for measuring absorption at short wavelengths. Detection capability of microwatts of absorbed energy is also possible with this system. Therefore, milliwatt sources and microgram samples may be utilized. Even though the pellet spectrophone responds primarily to absorbed energy it does not result in any data directly convertible to determination of the imaginary part of the complex refractive index except, perhaps under special conditions. This is due to problems regarding particle size distribution and involvement of the real part in scattering interactions. However, if all of these problems are recognized, use of the pellet spectrophone does result in good measurements of the absorption coefficient of the suspended material at whatever wavelengths tested and at whatever size distributions that exist in the host KBr pellet. GRA

N81-10346# ARO, Inc., Arnold Air Force Station, Tenn.

HOLOGRAPHIC INTERFEROMETRY AND IMAGE ANALYSIS FOR AERODYNAMIC TESTING Final Report, 1 Oct. 1976 - 30 Sep. 1978

J. E. OHare and W. T. Strike AEDC Sep. 1980 45 p refs Sponsored by Air Force

(AD-A089438; AEDC-TR-79-75) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report summarizes the progress achieved in the von Karman Gas Dynamics Facility VKF of the Arnold Engineering Development Center AEDC, Air Force Systems Command AFSC in the (1) development of operational techniques and hardware for recording holographic interferograms in the VKF wind tunnels, (2) development of automated image analysis techniques for reducing quantitative flow-field data from holographic interferograms, and (3) investigation and development of software for the application of digital image analysis to other photographic techniques used in wind tunnel testing. GRA

N81-10347# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.

MATERIALS RESEARCH FOR ADVANCED INERTIAL INSTRUMENTATION. TASK 1: DIMENSIONAL STABILITY OF GYRO STRUCTURAL MATERIALS Technical Report, 1 Oct. 1978 - 30 Sep. 1979

J. McCarthy and F. Petri Jun. 1980 38 p refs

(Contract N00014-77-C-0388)

(AD-A089598; R1388; TR-2) Avail: NTIS HC A03/MF A01 CSCL 14/2

Methods of microyield strength testing are described. The results of microyield strength measurements on hot isostatically pressed beryllium are presented as well as preliminary TEM examination of material in the as-pressed condition. Error trend data from instrument test is compared to errors predicted from a postulated microcreep law and uniaxial microcreep data. Results of creep analysis on a simple structural shape are presented. GRA

N81-10348# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

HOT WIRE TECHNIQUES: CONDITIONAL SAMPLING AND INTERMITTANCY

D. Olivari 1980 110 p refs Presented at VKI Lecture Ser. on Meas. and Predictions of Complex Turbulent Flows, Rhode Saint-Genese, Belgium, 11-15 Feb. 1980 Submitted for publication

(VKI-PREPRINT-1980-12) Avail: NTIS HC A06/MF A01

The technique of hot wire anemometry is described. Particular attention is given to: sensor types; calibration characteristics; control circuits; linearization; angular reponse; and measurement of turbulence. Some practical problems are also discussed. The feasibility and applications of conditional sampling of flow quantities is discussed in detail with special emphasis on the detection criteria for turbulent flow. Conditional averages and spatial structures are defined. The role of convention velocities in ensemble averages is evaluated. Author (ESA)

N81-10349# Health and Safety Executive, Sheffield (England).

A FAST-RESPONSE TWO-COLOR PYROMETER

D. P. Cutler May 1979 8 p ref

(HSL-TP-5; ISBN-0-7176-0014-9) Avail: NTIS HC A02/MF A01; Health and Safety Executive, Sheffield, England 50p

An instrument was developed to study the rate of the rise and fall of temperature of a rapidly heated surface of unknown emissivity. A day to day reproducibility of within + or - 35 C is achieved in measurements of temperatures in the range 500 to 1700 C with heating times, from ambient, of about 0.5 ms. The instrument is self-contained and incorporates outlet sockets to either an oscilloscope or waveform analyzer, and is housed within a modified camera body. The target is sighted using the focusing system of the camera. Author (ESA)

N81-10350*# New England Research Application Center, Storrs, Conn.

GYROSCOPES AND GYRO-STABILIZED SYSTEMS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Apr. 1980

C. Gilbert Young May 1980 198 p Sponsored in part by NTIS

(NASA-CR-163678; PB80-809031) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

The theory, design, construction, applications, and uses of gyroscopes are described in approximately 188 citations. Fiberoptic, electrostatic, microelectrostatic, cryogenic or super conducting, nuclear magnetic gyroscopes are discussed. Geophysical measurements, verifications of Einstein's theories, missile guidance, inertial navigation, platform stabilization are included. GRA

N81-10351*# New England Research Application Center, Storrs, Conn.

GYROSCOPES AND GYRO-STABILIZED SYSTEMS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Apr. 1980

C. Gilbert Young May 1980 180 p Sponsored in part by NTIS

(NASA-CR-163677; PB80-809056) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

The theory, design, construction, application and use of gyroscopes are described in approximately 197 citations. Fiber optic, electrostatic, microelectrostatic, cryogenic or super conducting, nuclear magnetic gyroscopes are discussed. Geophysi-

cal measurements, verifications of Einstein's theories, missile guidance, inertial navigation, platform stabilization are included. GRA

N81-10352# National Bureau of Standards, Washington, D.C. National Engineering Lab.
THE NBS GAGE BLOCK CALIBRATION PROCESS USING A MEASUREMENT ASSURANCE PROGRAM
Clyde D. Tucker Jun. 1980 10 p refs
(PB80-200132; NBSIR-80-2078) Avail: NTIS HC A02/MF A01 CSCL 14B

The calibration method for gage blocks, employing a measurement assurance program, is described for the user of an NBS calibration report. The various parameters and their significance to the calibration process are discussed. GRA

N81-10353# New England Research Application Center, Storrs, Conn.
LASER GYROSCOPES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Apr. 1980
C. Gilbert Young May 1980 91 p Sponsored in part by NTIS
(PB80-809114) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

Laser inertial rotation sensors are discussed in approximately 27 citations. Ring lasers, fiber optic ring lasers, and laser or optical gyroscopes are discussed. Technical problems, such as mode coupling and competition, stray scattering, error sources, and analyses, are treated. The design, engineering, construction, and performance of operational hardware are described. GRA

N81-10354*# New England Research Application Center, Storrs, Conn.
GYROSCOPES AND GYRO-STABILIZED SYSTEMS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1964 - Apr. 1980
C. Gilbert Young May 1980 139 p Sponsored in part by NASA and NTIS
(NASA-CR-163676; PB80-809049) Avail: NTIS HC $30.00/MF $30.00 CSCL 17G

The theory, design, construction, application and use of gyroscopes are described in approximately 137 citations. Fiberoptic, electrostatic, microelectrostatic, cryogenic or super conducting, nuclear magnetic gyroscopes are discussed. Geophysical measurements, verifications of Einstein's theories, missile guidance, inertial navigation, platform stabilization, are included. GRA

N81-10355*# New England Research Application Center, Storrs, Conn.
LASER GYROSCOPES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Apr. 1980
C. Gilbert Young May 1980 137 p Sponsored by NASA and NTIS
(NASA-CR-163650; PB80-809130) Avail: NTIS HC $30.00/MF $30.00

Laser inertial rotation sensors are detailed in this collection of 146 citations from the world literature. Ring lasers, fiberoptic ring lasers, and laser or optical gyroscopes are designations used and discussed here. Technical problems, such as mode coupling and competition, stray scattering, error sources, and analyses, are treated. The design, engineering, construction, and performance of operational hardware are described. GRA

N81-10356# New England Research Application Center, Storrs, Conn.
LASER GYROSCOPES. CITATION FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1980
C. Gilbert Young May 1980 116 p Sponsored in part by NTIS
(PB80-809122) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

Laser inertial rotation sensors are addressed in a bibliography containing 129 abstracts. Ring lasers, fiber optic ring lasers, and laser or optical gyroscopes are designations used and discussed here. Technical problems, such as mode coupling and competition, stray scattering, error sources, and analyses, are treated. The design, engineering, construction, and performance of operational hardware are described. GRA

N81-10357# National Bureau of Standards, Washington, D.C. National Engineering Lab.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: METROLOGY FOR SUBMICROMETER DEVICES AND CIRCUITS Final Report
W. Murray Bullis Jun. 1980 45 p refs
(PB80-204159; NBS-SP-400-61; LC-80-600054) Avail: NTIS HC A03/MF A01 CSCL 14B

The metrological requirements of semiconductor microelectronics are made more stringent not only because of the obvious demands associated with the smaller feature sizes of circuit elements but also because of the attendant requirements for more efficient design verification aids, computer simulations, and process validation and control techniques and because of the concurrent trend toward larger die and package sizes. The types of metrological requirements associated with submicrometer devices and structures are examined, the present state of the art in selected critical areas of metrology summarized, and current research and development efforts on advanced measurement technology reviewed.

N81-10942# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Systemtechnik.
A SMALL, EFFICIENT SUN POINTING BALLOON GONDOLA
J. How *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 183-187 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10971# Swedish Space Corp., Solna.
AN IMPROVED POWER AND TEMPERATURE CONTROL SYSTEM FOR A ROCKET-BORNE SPACE PROCESSING MIRROR FURNACE
S. Grahn, A. Nobinder, M. Sjoekvist, and L. Stenmark (Micro Nova Corp., Sweden) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 363-366 ref (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10973# Swedish Space Corp., Solna.
THE PRINCIPLES OF A SAMPLE-TRACKING SPACE PROCESSING FURNACE
S. Grahn *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 371-373 ref (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10974# Swedish Space Corp., Solna.
MURMEC: MULTIPURPOSE ROCKET-BORNE MATERIAL-SCIENCE EXPERIMENT CARRIER
R. Joensson, E. Soederdahl, and S. Wallin *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 375-380 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10989# Leeds Univ. (England). Dept. of Physics.
A MICROPROCESSOR-CONTROLLED FAR INFRARED SPECTROMETER
A. R. Clarke and I. Kirk *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 469-476 refs Sponsored in part by UK Science Research Council (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-10358 Polytechnic Inst. of New York.
HIGH-ENERGY PULSED LASER INTERACTION WITH

METALLIC SURFACES Ph.D. Thesis
To Hoon Kim 1980 178 p
Avail: Univ. Microfilms Order No. 8019399

Some properties of laser material interactions in vacuum were investigated during intense laser irradiation by a Q switched ruby laser pulse of 20 nsec FWHM and 0.61 output power. Reflectance (total, spectral and probe laser), spectroscopic analysis and microstructural observations were examined. Primarily Cu, Sn, Zn, Bi, Al, Fe and Si samples were investigated. The intensities of incident laser on the target were in the range of 10 to the 7th power - 10 to the 9th power w/cu cm. In both total and specular reflectance measurements the reflected light signal from the target and a sample signal of incident laser pulse were detected by a single detector system with a rise time < 1 nsec. An integrating sphere was used for the total reflectance measurement. An interference filter at the ruby laser wavelength was used in front of the detector to remove the observed 'light flash' from a plasma created at or in front of the target surface. The original input pulses reflected from the target into the integrating sphere were recovered from the output pulses leaving the sphere using an impulse response method. The recovered reflected and the sample pulses were then used to determine the time resolved total reflectance curves. Dissert. Abstr.

N81-10359 Dartmouth Coll., Hanover, N.H.
A CERENKOV-RAMAN MASER Ph.D. Thesis
Kenneth Owen Busby 1980 167 p
Avail: Univ. Microfilms Order No. 8024283

The first observations of coherent microwave radiation resulting from Cerenkov-Raman backscattering are reported. An experimental investigation of vacuum Raman backscattering is discussed and theoretical models are presented to calculate the frequency and the gain at interaction for both the Raman and the Cerenkov-Raman backscattering interactions. Experimental data are compared to theoretical predictions. Dissert. Abstr.

N81-10360 Rochester Univ., N. Y.
PHOTOACOUSTIC INVESTIGATION OF INFRARED ABSORPTION, INHOMOGENEITY, AND LASER DAMAGE IN SOME HIGHLY TRANSPARENT SEMICONDUCTOR THIN FILMS, SUBSTRATES, AND POWDERS Ph.D. Thesis
Robert Paul Freese 1980 326 p
Avail: Univ. Microfilms Order No. 8023922

Two dimensional photoacoustic mappings are obtained on several thin film germanium (t = .65 micron to 1.23 micron) on germanium samples using a 100 mW CO2 laser source and an optimized photoacoustic cell design. Results show that optical absorption can be measured in this manner as a function of space. The photoacoustic mappings also reveal several thin film and substrate inhomogeneities. Frequency studies indicate that some of these are subsurface and may be nondestructively located if the thermal properties of the sample are well known. Single pulse CO2 laser damage studies conducted on the thin film germanium samples reveal that the location of damage sites correlates extremely well with the position of the inhomogeneities or interference effects which were detected photoacoustically before the damage test. A dual beam infrared photoacoustic spectrometer was used to obtain quantitative absorption spectra of the powder particles. Absorption coefficients of the germanium particles agreed well with data measured from large polished flats and the spectra of CdCr2Se4 and CdCr2S4 revealed the presence of several intrinsic and extrinsic absorption mechanisms. Dissert. Abstr.

N81-10361 Maryland Univ., College Park.
CO2 WAVEGUIDE TE LASER Ph.D. Thesis
Hsin An Li 1980 132 p
Avail: Univ. Microfilms Order No. 8025280

A specially constructed CO2 waveguide TE laser has several advantages over a conventional CO2 TE laser on account of its compact size, higher repetition rate, purity of polarization rate and so on. A five temperature model of the laser system is derived and then solved numerically. The relative numerical results are in close agreement with the experimental data. The laser output signature and polarization state are accurately predicted by this theory. Discrepancy exists between the theoretically predicted and measured output power which is due to the assumption of a uniform electrical discharge in the theory. Various preionization schemes could be employed to enhance the laser efficiency and produce more uniform discharges such that the theory would give a more accurate description of this particular laser device. Dissert. Abstr.

N81-10362 Brigham Young Univ., Provo, Utah.
A FREQUENCY SHIFTED LASER INTERFEROMETER Ph.D. Thesis
David Russell Huber 1980 120 p
Avail: Univ. Microfilms Order No. 8025612

The design, construction, testing and utilization of a frequency shifted laser (He-Ne) interferometer for use on the topolotron, a pulsed plasma machine are considered. The interferometer provides a time history of the average electron density along a selected chord. The rms noise level of the interferometer is two degrees over a fifty-four microsecond time interval. The plasma and reference beams are optically heterodyned to produce an 80 MHz beat frequency which is phase modulated by changes in the plasma electron density. The modulated optical beat frequency is carried by an optical fiber into a low noise environment where the base band phase and amplitude information is recovered and displayed by a minicomputer. Dissert. Abstr.

N81-10363# National Bureau of Standards, Boulder, Colo.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS, 1979
Harold E. Bennett, ed. (Naval Weapons Center), Alexander J. Glass, ed. (California Univ., Lawrence Livermore Labs., Livermore), Arthur H. Guenther, ed. (AFWL, Kirtland AFB, N. Mex.), and Brian E. Newman, ed. (LASL) Jul. 1980 533 p refs Symp. held in Boulder, Colo., 30-31 Oct. 1979; sponsored by Am. Soc. for Testing and Mater., ONR, DOE, and DARPA
(AD-A088560; NBS-SP-568; LC-80-600100) Avail: NTIS HC A23/MF A01 CSCL 20/5

Information about optical materials for high power lasers was exchanged. Other topics discussed include: transparent optical materials and the measurement of their properties; mirrors and surfaces; thin film characteristics; and thin film damage. For individual titles, see N81-10364 through N81-10408.

N81-10364# National Bureau of Standards, Boulder, Colo.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS: INTRODUCTION
In its Laser Induced Damage in Opt. Mater. Jul. 1980 p 1-38 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Transparent optical materials and the measurement of their properties, mirrors and surfaces, thin film characteristics, thin film damage, considerations for high power systems, and finally theory and breakdown were discussed. Particular emphasis was given to materials for high power apparatus. The wavelength range of prime interest was from 10.6 micrometers to the UV region. Highlights included: surface characterization; thin film substrate boundaries; and advances in fundamental laser matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength was discussed. R.K.G.

N81-10365# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
PRESS FORGING AND OPTICAL PROPERTIES OF LITHIUM FLUORIDE
J. F. Ready and H. Vora *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 39-46 refs (For primary document see N81-10363 01-36)
(Contract ED-78-C-08-1555)
Avail: NTIS HC A23/MF A01

Lithium fluoride is an important candidate material for windows on high power, short-pulse ultraviolet and visible lasers. Lithium fluoride crystals were press forged in one step over the temperature range 300 to 600 C to obtain fine grained polycrystalline material with improved mechanical properties. The deformation that can be given to a lithium fluoride crystal during forging is limited by the formation of internal cloudiness (veiling) with the deformation limit increasing with increasing forging temperature from about 40 percent at 400 C to 65 percent at 600 C. To suppress veiling, lithium fluoride crystals were forged in two steps over the temperature range 300 to

600 C, to total deformations of 69 to 76 percent, with intermediate annealing at 700 C. This technique yields a material which has lower scattering with more homogeneous microstructure than that obtained in one step forging. The results of characterization of various optical and mechanical properties of single crystal and forged lithium fluoride, including scattering, optical homogeneity, residual absorption, damage thresholds, environmental stability, and thresholds for microyield are described. R.K.G.

N81-10366# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

OPTICAL PROPERTIES OF FORGE CaF2

A. K. Hopkins, R. H. Anderson (Honeywell Corporate Material Sciences Center), J. F. Ready (Honeywell Corporate Material Sciences Center), J. M. Bennett (Naval Weapons Center), P. C. Archibald (Naval Weapons Center), and D. K. Burge (Naval Weapons Center) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 47-64 refs (For primary document see N81-10363 01-36)

Avail: NTIS HC A23/MF A01

Strengthened, fine grain polycrystalline CaF2 can be routinely obtained by isostatic forging. When the deformation of the single crystal exceeds 50 percent, veiling appears within the bulk of the forging and increases with increasing deformation. The effects of forging and the resultant veiling on the optical properties of CaF2 were assessed. Scattering measurements were made in the visible and at 3.39 micrometers. These forgings were isostatically hot pressed (HIP) in an effort to eliminate the veiling. The scattering levels in the visibility and at 3.39 micrometers were remeasured. Homogeneity measurements were obtained using two different methods for single crystal, forged and forged plus HIP CaF2. Photographs of the stress birefringence in the same three conditions were also taken. These optical data are presented and discussed. R.K.G.

N81-10367# Dayton Univ., Ohio.

MECHANICAL AND OPTICAL PROPERTIES OF FORGED NaCl

George A. Graves, John A. Detrio, Dale McCullum, and David A. Dempsey *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 65-72 ref Sponsored by AF (For primary document see N81-10363 01-36)

Avail: NTIS HC A23/MF A01

The mechanical and infrared laser absorption properties were determined on test specimens cut from a 32 cm diameter forging of Polytran Nacl produced by Harshaw. The homogeneity of the mechanical and optical properties statistically showed a significant dependence of the ultimate strength on azimuthal position in the forging. The absorption of the specimens at CO2, CO, HF/DF, and Nd:YAG laser wavelengths were measured and no significant dependence on specimen location was observed. The absorption variations were less than 10 percent for all of the laser wavelengths studied except at 3.8 micrometers (40 percent). Other properties examined include: specific heat; thermal expansion; and hardness. Strength measurements were made with both uniaxial flexural bars and biaxial disc test specimens. Author

N81-10368# Dayton Univ., Ohio.

OPTICAL, THERMAL, AND MECHANICAL MEASUREMENTS ON CO2 LASER-IRRADIATED ZnSe

J. A. Detrio, J. A. Fox, and J. M. OHare *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 73-89 refs Sponsored by AF (For primary document see N81-10363 01-36)

Avail: NTIS HC A23/MF A01

The laser power dependence of the temperature distribution, optical distortion, and strain were measured for specimens of ZnSe with absorption values between 0.006 and 0.020. For a well behaved Gaussian beam profile a thermal lensing effect which changes the location of the beam waist but does not significantly increase the minimum beam diameter was observed. The predicted and measured temperature rise agree for laser powers of 230 and 705 watts and beam diameters of 2.1 mm and 4.2 mm, respectively. The identification of factors which influence the departure of predicted from measured response are discussed. The precision of the model is also examined. R.K.G.

N81-10369# Rochester Univ., N. Y. Lab. for Laser Energetics.

ELECTRONIC, NUCLEAR AND TOTAL NONLINEAR INDICES OF LIQUIDS

David C. Brown, J. M. Rinefierd, S. D. Jacobs, and J. A. Abate *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 91-98 refs Sponsored by Exxon Research and Engineering Co., GE, Northeast Utilities, Empire State Electric Energy Research Corp. and New York State Energy Research and Development Authority (For primary document see N81-10363 01-36)

Avail: NTIS HC A23/MF A01

The nonlinear indixes of a wide variety of liquids are reported. Based upon measurement of linear indexes and calculation of the Abbe value, the electronic contribution to the total nonlinear index was obtained. Using measurements tabulated recently, the nuclear and total nonlinear indexes were calculated. Agreement between the total nonlinear index and measurements reported in the literature and the correlation with Abbe value and linear index are discussed. R.K.G.

N81-10370# California Univ., Los Angeles. Dept. of Physics.

WAVELENGTH MODULATION SPECTROSCOPY OF HIGHLY TRANSPARENT SOLIDS

Rubin Braunstein, Ryu K. Kim, and Morris Braunstein (Hughes Research Labs., Malibu, Calif.) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 99-118 refs Sponsored by AFOSR (For primary document see N81-10363 01-36)

Avail: NTIS HC A23/MF A01

Wavelength modulation spectroscopy was used to measure the absorption in highly transparent solids. Wavelength modulation techniques were used in conjunction with laser calorimetry to study absorption in the ultraviolet and visible regions. A wavelength modulated spectrometer system was constructed to encompass the dominant HF, DF, CO, and CO2 laser wavelengths. The richness of structure observed throughout this spectra region provides a possible identification of surfaces and volume contaminants as well as intrinsic absorption processes in solids. Results on KBr and other alkali halides are presented. S.F.

N81-10371# Naval Research Lab., Washington, D. C.

SYNCHROTRON RADIATION STUDIES OF BERYLLIUM FLUORIDE GLASS

R. T. Williams, D. J. Nagel, P. H. Klein, and M. J. Weber (California Univ., Lawrence Livermore Lab., Livermore) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 119-124 refs Sponsored by DARPA, DOE and ONR (For primary document see N81-10363 01-36)

Avail: NTIS HC A23/MF A01

Beryllium fluoride glasses are possible materials for high power laser systems because of their low nonlinear refractive indexes. In addition the linear refractive index of BeF2 is extremely small, so that it may be of use in multilayer coatings for the ultraviolet. Reflectance of pure BeF2 glasses in the range 9 eV to 120 eV, as well as photoelectron spectra of the bulk glass in the valence band region were measured. Ultraviolet reflectivity and photoemission are useful measurements for indicating the ultimately achievable transmission edge since they sample very high densities of states, assumed intrinsic in nature. Both methods probe only the near surface region, so the hygroscopic nature of BeF2 presents a problem. An argon sputter etching gun was used to clean the samples in ultrahigh vacuum prior to measurement. S.F.

N81-10372# Sanders Associates, Inc., Nashua, N. H.

PROPERTIES AND FABRICATION OF CRYSTALLINE FLUORIDE MATERIALS FOR HIGH POWER LASER APPLICATIONS

T. M. Pollak, R. C. Folweiler, E. P. Chicklis, J. W. Baer, A. Linz (MIT, Cambridge), and D. Gabbe (MIT, Cambridge) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 127-135 refs Sponsored by DOE (For primary document see N81-10363 01-36)

Avail: NTIS HC A23/MF A01

Fabrication and properties of two fluoride crystal families which exhibit a natural rare earth site are described. Two crystalline fluorides, yttrium lithium fluoride, or LiYF4, and potassium yttrium fluoride, or KY3F10, have specific desirable properties for high power laser applications. Advanced material processing techniques were developed, including feed purification and crystal growth

techniques, to fabricate fluoride crystals exhibiting excellent transmission, low scattering, and high resistance to laser damage. Crystal growth developments scaled the crystal growth of YLF to 100 mm diameter. Growth parameters were optimized to maintain proper crystal-melt interface to minimize the formation of defects. Technical problems were addressed in scaling the crystal growth of YLF to 40 cm diameter. S.F.

N81-10373# Naval Research Lab., Washington, D. C.
LASER DAMAGE IN YTTRIUM ORTHOPHOSPHATE
R. Allen, L. Esterowitz, P. H. Klein, V. O. Nicolai (ONR, Arlington, Va.), and W. K. Zwicker (Philips Labs., Briarcliff Manor, N.Y.) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 137-140 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Laser damage experiments on single crystal blades of yttrium orthophosphate were performed. Crystals were grown by slow cooling of a flux containing lead pyrophosphate. Optical absorption is small from about 300 nm to about 3200 nm, approximating the transmission of calcite. A 1.06 micrometer neodymium glass laser with Q-switched pulse duration of 17 ns was used for damage measurements. The laser beam (0.025 cm FWHM) was focussed on the large face of the YPO4 crystals. Visible damage was always observed at front and back crystal surfaces following exposure to pulses averaging 3.6 GW/square centimeter or more. No visible damage was found in YPO4 at power densities less than 2.2 - 2.4 GW/square centimeter. Calcite crystals showed damage at somewhat smaller power densities. S.F.

N81-10374# Raytheon Co., Bedford, Mass. Missile Systems Div.
COMPRESSIVE FAILURE IN SAPPHIRE UNDER CO2 LASER HEATING
P. A. Miles, J. Gallagher, and R. L. Gentilman (Raytheon Co., Waltham, Mass.) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 141-149 refs (For primary document see N81-10363 01-36)
(Contract F336615-77-C-5280)
Avail: NTIS HC A23/MF A01

Irreversible changes were observed in sapphire crystals subjected to surface heating by CO2 laser irradiation at levels above 300 watts/square centimeter. The changes are interpreted as due to plastic flow under compressive stress at temperatures above 900 C. The recognition of possible compressive failures in refractory oxides is of importance in defining laser tolerance levels in high power optics, in the design of laser heating experiments to assess the thermal shock resistance of materials, and possibly in the field of laser assisted machining of ceramics. A detailed thermomechanical analysis was carried out to predict the temperature and stress conditions throughout disk samples as a function of time, heat flux level and flux distribution. Compressive stresses in excess of 200,000 psi were generated. Compressive failure is likely to precede tensile fracture in most experiments where partially heated disks are used. S.F.

N81-10375# Dayton Univ., Ohio.
FAILURE CRITERIA FOR LASER WINDOW MATERIALS
John A. Detrio, George A. Graves, and James M. Wimmer (AiResearch Mfg. Co., Phoenix, Ariz.) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 151-151 refs Sponsored by AFML (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The brittle mechanical behavior of laser window materials is considered in the establishment of failure criteria for selecting candidate materials and in the design of window components. The statistical techniques employed in brittle materials design and analysis are reviewed. The influence of the limited plasticity observed for the alkali halides, which exhibit fracture failure, is also discussed. Author

N81-10376# Lockheed Missiles and Space Co., Palo Alto, Calif.
THERMOMECHANICAL STRESS DEGRADATION OF METAL MIRROR SURFACES UNDER PULSED LASER IRRADIATION
Henry M. Musal, Jr. *In* NASA. Laser Induced Damage in Opt. Mater. Jul. 1980 p 159-173 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Progressive degradation of the optical surface of metal mirrors in pulsed laser applications can result from cumulative plastic deformation under thermomechanical stress caused by relatively small temperature excursions during irradiation. An analysis of the transient stress-strain behavior of the near surface region above that elastic response is maintaned below a limiting surface temperature rise (delta t syb y), which depends on the yield stress, modulus of elasticity, Poisson's ratio, and coefficient of thermal expansion of the metal. This temperature rise defines the threshold for first pulse yield at the surface. An elastic plastic model of metal behavior shows that the increment of plastic strain accumulated during each successive laser pulse will be proportional to the temperature rise above 2 delta t sub y. This plastic strain will appear at the surface as slip bands and intergranular slip that progressively degrades the optical quality of the surface. The surface temperature rise of metal mirrors under pulsed laser irradiation depends on both the metal optical and thermal properties as well as the laser pulse parameters. Author

N81-10377# Naval Weapons Center, China Lake, Calif. Physics Div.
DEFECT-DAMAGE-RESISTANT COPPER MIRRORS
J. O. Porteus, D. L. Decker, D. J. Grandjean, S. C. Seitel, and W. N. Faith *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 175-186 refs Sponsored in part by AFWL (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The calculated threshold for 10.6 micrometer laser induced melting of intrinsic crystalline copper is in excellent agreement with the latest experimental value when the 100 nsec pulse shape and temperature dependent material properties are properly modeled. Melt thresholds of diamond turned copper mirrors recently produced and tested are very nearly intrinsic. However, laser induced pitting related to surface defects often causes failure at a considerably lower level. A well defined inverse relationship between the thresholds for laser induced slip and melting provides a good indication of surface disorder on polished, as well as diamond turned mirrors. Thermal modeling indicates that the premature melting can be avoided by improving the thermal conductivity of the substrate. Author

N81-10378# Aarhus Univ. (Denmark). Inst. of Physics.
LASER DAMAGE RESISTANT COPPER SURFACES WITH HIGH REFLECTIVITY AFTER OXIDATION
M. Oron, L. G. Svendsen, and G. Sorensen *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 187-193 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Ion implantation of aluminum into copper was used to produce mirror surfaces with improved properties with respect to pulsed laser damage. Upon oxidation of implanted samples, they show a much higher reflectivity of the laser pulse compared to nonimplanted samples. The oxidation followed by Rutherford backscattering technique and nuclear reactions, and the improved surface properties are explained by the presence of compound oxide layer beneath the surface, which shows greater stability against decomposition than the pure metal oxide. This novel coating technique, comprising ion implantation and oxidation may be advantageous in improving surface properties such as reflectivity of metal mirrors. Author

N81-10379# Naval Weapons Center, China Lake, Calif. Physics Div.
LASER INDUCED BREAKDOWN OF DIAMOND MACHINED WINDOW SURFACES
M. J. Soileau, J. O. Porteus, and D. L. Decker *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 195-197 refs Sponsored in part by ONR (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The effect of laser conditioning was examined by comparing thresholds and surface characteristics on areas of the surface exposed to nondamaging laser pulses (n-on-1 effect). The so-called n-on-1 effect was found to be wavelength selective with a much larger effect seen at 2.7 than at 3.8 micrometers. This result provides information on machining damage and may have important implications for laser processing as a possible means

of improving the performance of machined optical surfaces. Surfaces prepared by precision diamond machining are compared with surfaces prepared by conventional polishing. The results indicate that the diamond machined surfaces have as high or higher failure resistance under high fluence loading as surfaces prepared using conventional techniques. Failure of both types of surfaces is strongly dependent upon surface structure and surface contamination. Laser conditioning experiments indicate that absorbed surface water is a significant contributor to surface failure under high fluence loading at 2.7 micrometers. Author

N81-10380# Naval Weapons Center, China Lake, Calif. Physics Div.

LASER INDUCED BREAKDOWN OF DIAMOND MACHINED WINDOW SURFACES

M. J. Soileau, J. O. Porteus, and D. L. Decker *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 199-208 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The results of the diamond turning of surfaces of a wide range of single crystal and polycrystalline infrared window materials, including Ge, C3F2, MgF2, SrF2, KC1, and GaAs are presented. These surfaces were obtained from an advanced air bearing, diamond turning machine recently brought to an operational state at the Naval Weapons Center. The examination includes an analysis of scattered and absorbed light, and a surface microtopographic examination by diamond profilometry, phase contrast interference (Nomarski), and scanning electron microscopy. These data are compared with earlier results and are related to the characteristics of the Naval Weapons Center diamond turning machine and to the machining parameters. Author

N81-10381# Los Alamos Scientific Lab., N. Mex.

SHORT PULSE CO2 LASER DAMAGE STUDIES OF NaCl AND KCl WINDOWS

Brian E. Newman, Andrew V. Nowak, and Dennis H. Gill *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 209-227 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The damage resistance of bare surfaces and the bulk interior of NaCl and KCl windows was measured with a short pulse CO2 laser at 10.6 micrometers. Parametric studies with 1.7 ns pulses indicated that adsorbed water was probably the limiting agent on surface thresholds in agreement with previous studies at long pulsewidths. Rear surface thresholds up to 7 J/sq cm were measured for polished NaCl windows, whereas KCl surfaces damaged at approximately 60% of this level. The breakdown electric field thresholds of exit surfaces were only 50% of the value of the bulk materials. The pulsewidth dependence of surface damage from 1 to 65 ns, in terms of incident laser fluence, increased as the cube root of t. Author

N81-10382# Naval Weapons Center, China Lake, Calif.

CO2 LASER POLISHING OF FUSED SILICA SURFACES FOR INCREASED LASER DAMAGE RESISTANCE AT 1.06 MICRONS

P. A. Temple, David Milam (California Univ., Livermore, Lawrence Livermore Lab.), and W. Howard Lowdermilk (California Univ., Livermore, Lawrence Livermore Lab.) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 229-236 refs Sponsored in part by DOE (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Bare fused silica surfaces were prepared by subjecting the mechanically polished surface to a rastered CW CO2 laser beam. Analysis shows that this processing causes removal of a uniform layer of fused silica and a silica removal rate is found to be a function of the laser intensity and scan rate. These surfaces are seen to have very low scatter and to be very smooth. In addition, they have exhibited entrance surface damage thresholds at 1.05 microns and 1 nsec, which are substantially above those seen on the mechanically polished surface. When damage does occur, it tends to be at a few isolated points rather than the general uniform damage seen on the mechanically polished part. In addition to the damage results, an observational technique used for viewing these surfaces which employs dark-field illumination is discussed. J.M.S.

N81-10383# Naval Weapons Center, China Lake, Calif.

THE RELATIVE IMPORTANCE OF INTERFACE AND VOLUME ABSORPTION BY WATER IN EVAPORATED FILMS

T. M. Donovan, P. A. Temple, Shiu-Chin Wu (California Inst. of Technology, Pasadena), and T. A. Tombrello (California Inst. of Technology, Pasadena) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 237-246 refs Sponsored in part by DARPA (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Hydrogen concentrations and profiles measured using a nuclear resonant technique are correlated with previous calorimetric measurements. Results show, for example, that H2O is uniformly distributed in materials such as NaF and ThF, but occurs at the film substrate interface in materials such as As2Se3 and 2nS. The relative effectiveness of encapsulation of NaF and ThF4 by 2nS is discussed. Good agreement is found between measured absorption and that calculated from measured hydrogen profiles. J.M.S.

N81-10384# Utah State Univ., Logan.

CHARACTERIZATION OF SMALL ABSORPTIONS IN OPTICAL COATINGS

Wilford N. Hansen, Lee Pearson (Air Force Academy), Galen Hansen, and Wayne J. Anderson *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 247-256 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The problems of identifying absorbing species, locating them in the optical structure, and measuring the amount of absorbing species present are addressed. The importance of an absorbing species at a given location in the structure is directly proportional to the relative electromagnetic field squared at that location. This fact is used both to avoid absorption when it isn't wanted and to enhance absorption when it is wanted, such as during analysis. Versatile and sensitive spectroscopic procedures for locating and characterizing small absorptions are discussed. The approach makes use of Poynting's theorem. Emphasis is on thorium fluoride, zinc sulfide, zinc selenide, and silicon monoxide films on silver, germanium, and zinc selenide substrates. Significant absorbing foreign species were found in all films tested. J.M.S.

N81-10385# Air Force Weapons Lab., Kirtland AFB, N. Mex.

SURFACE MICROANALYSIS TECHNIQUES FOR CHARACTERIZATION OF THIN FILMS

T. W. Humpherys, R. L. Lusk, and K. C. Jungling *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 257-268 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

With the advent of lower wavelength systems, increased sophistication of functional requirements, and higher incident radiation levels, more stringent demands have been placed on coating depositions with complimentary detailed chemical and physical characterizations being required. Scanning auger microscopy, X-ray photoelectron spectroscopy, and secondary ion mass spectroscopy techniques were applied to thin film coatings to detect and identify compositional and structural irregularities. Impurity sites in ThF4 and ZnS films, principle causes of poor coating performance, were isolated and analyzed. Point maps, line scans, and depth profiles are shown to provide remarkable clarity with submicron resolution. Abnormal oxygen content in ThF4 films indicates the presence of water and may eliminate its use as a coating material for HF systems. Although these surface analysis methods are destructive by nature, the validity of their use in analyzing thin film coatings is demonstrated and establishes a precedent for coating development progress. J.M.S.

N81-10386# Technische Universitaet, Hanover (West Germany).

PYROELECTRIC MEASUREMENT OF ABSORPTION IN OXIDE LAYERS AND CORRELATION TO DAMAGE THRESHOLD

H. Kuester and J. Ebert *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 269-279 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The absorption of several oxide layers used in HP laser optics was measured by a fast pyroelectric detector in the range from 600 to 2000 C. The layers of Al2O3, BeO, MgO, HfO2,

ZrO2, Nd2O3, CeO2, TiO2 and SiO2 thickness about 0.5/ micron were electron gun evaporated on Suprasil 1 substrates. Damage thresholds were obtained with 800 ns - pulses from an unstable resonator type No(3+) glass laser with a Gaussian far field intensity profile. The occurrence of damage is determined by electronic registration of laser induced scattering. The results were analyzed to determine relations with layer absorption, absorption edge, and thermal conductivity. Author

N81-10387# Arizona Univ., Tucson. Optical Sciences Center.
HIGH TEMPERATURE OPTICAL CHARACTERIZATION OF THIN FILM REFLECTOR AND ABSORBER LAYER
M. R. Jacobson and R. D. Lamoreaux *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 281-286 ref (For primary document see N81-10363 01-36)
(Contracts ER-78-S-02-4899; EY-75-S-04-3709; F49620-77-C-0138)
Avail: NTIS HC A23/MF A01

A high temperature spectrophotometer (HTS) capable of measuring the temperature dependent, reversible changes in reflectance and transmittance of thin films was developed. The effective spectral range of the instrument - 0.38 to 15 microns covers 98% of the solar air mass 2 spectrum, as well as 94% of the radiation from a 500 C blackbody. A tungsten halogen, or globar source, provides two beams which are recombined before leaving the vacuum chamber. A Leiss sodium chloride monochromator disperses the radiation, which is detected by either a silicon or a thermocouple detector, depending on wavelength range. A microcomputer controlled sample and hold data acquisition system compares the two beams, corrects for background, and initiates data analysis. To minimize irreversible chemical changes in the films, a vacuum on the order of 5 million Torr is maintained by a diffusion pump in the central chamber. Cartridge heating assemblies raise the sample substrate temperatures to 700 C in reflectance and 500 C in transmittance; chromel-alumel thermocouples embedded and cemented into the substrates monitor temperatures. J.M.S.

N81-10388# Arizona Univ., Tucson. Optical Sciences Center.
CVD MOLYBDENUM THIN FILMS FOR HIGH POWER LASER MIRRORS
G. E. Carver and B. O. Seraphin *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 287-292 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Molybdenum thin films were prepared by chemical vapor deposition (CVD) from both molybdenum carbonyl and molybdenum pentachloride. The crystal structure, grain size and composition of the films were determined and related to their infrared reflectance. Post deposition annealing raises the absolute reflectance of films deposited from the carbonyl to 98.73 percent at ten micrometers. These films are prepared without a polishing step and their reflectance is 0.5 percent higher than that of super smooth polished bulk molybdenum. The higher reflectance and absence of a polish induced damage layer could increase the damage threshold of uncoated CVD molybdenum mirrors. Films deposited from the chloride have largely reproduced the optical properties of those prepared from the carbonyl, with grain sizes ranging from 0.03 to 0.5 micrometer. Polished bulk molybdenum substrates could be further smoothed by first overcoating them with, and subsequently polishing of, a several micron thick layer of fine grained CVD molybdenum. R.K.G.

N81-10389# Dayton Univ., Ohio.
PHOTOACOUSTIC EXPERIMENTAL STUDIES ON AN AR COATED LASER WINDOW AND SOME RELATED THEORETICAL CALCULATIONS
Nils C. Fernelius *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 293-300 refs Sponsored by AFML (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Experimental photoacoustic spectroscopy (PAS) amplitude and phase results on an AR coated ZnSe laser window were obtained at 10.6 micrometers as a function of chopping frequency. The PAS phase angle varied by 20 deg between 1000 Hz and 50 Hz; 7 deg between 1000 Hz and 100 Hz. Theoretical calculations related to the situation were performed using the Bennett-Forman and Rosencwaig-Gersho PAS theories. A 7 deg phase change was obtained for $r = 0.03$ cm. The homogeneous sample Rosencwaig-Gersho theory did not fit either amplitude or phase angle data. R.K.G.

N81-10390# Dayton Univ., Ohio.
CALCULATIONS USING A TWO-LAYER ROSENCWAIG-GERSHO PHOTOACOUSTIC SPECTROSCOPY THEORY APPLIED TO AN ANTI-REFLECTIVE COATED LASER WINDOW
Nils C. Fernelius *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 301-311 refs Sponsored by AFML (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The ZnSe laser window studied experimentally had an AR coating consisting of a ZnS outer layer 0.32 micrometer thick with a ThF4 inner layer 0.99 micrometer thick. Laser calorimetry experiments at 10.6 micrometers on other samples indicated that ThF4 films have an appreciable optical absorption of approx 10/cm. Calculations were performed using a two layer modification of the Rosencwaig-Gersho photoacoustic spectroscopy theory. A 7 deg phase change between 1000 Hz and 100 Hz was obtained for a coating bulk absorption of Beta sub c = 2.7/cm. Plots of this result along with the best fit using the Bennett-Forman theory in the previous abstract give similar amplitude and phase results. Examples of results for various Beta sub c and coating thickness results are given. R.K.G.

N81-10391# Rochester Univ., N. Y. Inst. of Optics.
PRE-PULSE IDENTIFICATION OF LOCALIZED LASER DAMAGE SITES IN THIN FILMS USING PHOTOACOUSTIC SPECTROSCOPY
Robert P. Freese and Kenneth J. Teegarden *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 313-332 refs (For primary document see N81-10363 01-36)
(Contract EY-76-S-02-4056)
Avail: NTIS HC A23/MF A01

Scanning photoacoustic spectroscopy techniques were used to monitor optical absorption and inhomogeneity in thin films and substrates. Samples examined were 25 mm square by 2.5 mm thick germanium substrates which were partially coated with a thin film of germanium. Inter-sample thin film thicknesses varied from .65 micrometer to 1.23 micrometers. Raster scans made at 10.6 micrometers using a 75 mW CO2 laser indicate that thin film and substrate inhomogeneities as well as optical absorption may be nondestructively measured at rates in excess of 400 msec per resolution point. Average absorptance results are in good agreement with those obtained by laser calorimetry and transmission techniques. Chopping frequency studies indicate that some of the inhomogeneities are subsurface. Interference effects detected photoacoustically are used to compute the skew angle between the front and back surfaces. When the sample is exposed to a 40 nsec (FWHM) CO2 laser pulse focused to a spot size of 3.5 nm, gross laser damage is found to occur where the interference effects were photoacoustically detected. Author

N81-10392# Naval Weapons Center, China Lake, Calif. Physics Div.
EXAMINATION OF LASER DAMAGE SITES OF TRANSPARENT SURFACES AND FILMS USING TOTAL INTERNAL REFLECTION MICROSCOPY
P. A. Temple *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 333-341 refs Sponsored by Navy and DOE (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Total internal reflection microscopy (TIRM), a microscopic inspection technique useful in examining the laser damaged surfaces of transparent samples is described. In this technique, the surface is illuminated from within the sample with a well collimated polarized laser beam at an angle of incidence just greater than the critical angle. Since total reflection occurs, the illuminated region appears to be dark when viewed from outside the sample except for scatter caused by surface defects such as laser damage sites. Two instruments used for TIRM inspection of samples are described. Various damaged regions shown as they appear under TIRM inspection and under Nomarski microscopy. On highly polished surfaces, TIRM shows somewhat more detail than does Nomarski microscopy. All of the

damage sites shown are the result of 1.06 micrometers, 1 nsec irradiation of used silica or BK-7 surfaces. R.K.G.

N81-10393# Aerojet Electrosystems Co., Azusa, Calif.
PARAMETERS AFFECTING DAMAGE THRESHOLD IN THIN FILM INFRARED
W. E. Kienzle (Science Applications, Inc., El Segundo, Calif.) and N. I. Marzwell (Rocketdyne, Canoga Park, Calif.) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 343-354 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Control of film deposition is important in determining the threshold of film damage due to a laser pulse. The optical properties of the infrared chalcogenide glass material T12Se-As2Te3 as process parameters are varied are reported. Several RF sputtered chalcogenide glass films of thicknesses varying from 0.6 micrometers to 8.9 micrometers were deposited on germanium and sapphire. The index of refraction and absorption coefficient were determined from the measured reflectance and transmittance curves for these samples. These properties were measured for two different sputtering pressures, two sputtering voltages, twelve azimuthal target positions and three different substrate to target distances. The damage due to switching was assessed by subjecting different switches to CO2 laser pulses with FWHM of 2 to 4 msec and energies up to 0.16 Joules which were focused on target spot diameter of 0.4 mm on the chalcogenide optical switch. S.F.

N81-10394# Honeywell Systems and Research Center, Minneapolis, Minn.
IMPROVEMENTS IN CLARITY AND ENVIRONMENTAL STABILITY OF Ti-CONTAINING ANTIREFLECTIVE COATINGS
W. T. Boord, P. P. Chow, W. B. Harrison (Honeywell, Inc., Golden Valley, Minn.), and J. E. Starling (Honeywell, Inc., Golden Valley, Minn.) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 355-357 (For primary document see N81-10363 01-36) (Contract F33615-77-C-5038)
Avail: NTIS HC A23/MF A01

Clarity of T11 films in visible light was improved by masking the textures of poly-crystalline KCl substrates with thin SrF2 films. The use of more environmentally durable fluoride films as replacements for KCl in the T11-KCl-T11 10.6 micron anti-reflective coating system was investigated. Author

N81-10395# Battelle Pacific Northwest Labs., Richland, Wash.
REACTIVELY SPUTTERED OPTICAL COATINGS FOR USE AT 1064 nm
W. T. Pawlewicz, R. Busch, D. D. Hays, P. M. Martin, and N. Laegreid *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 359-375 refs Sponsored by DOE (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Optical coatings of TiO2, In1.9Sn0.1O3 (ITO), Ta2O5, Nb2O5, a-Si:H and SiO2 have been prepared by reactive sputtering for use with lasers operating near 1064 nm. Damage thresholds of 7-10 J/square centimeter for TiO2 and 5-6 J/square centimeter for transparent-conductive ITO were measured for lambda/2 coatings on fused silica irradiated with 1 nsec laser pulses. Sputtered Ta2O5, Nb2O5 and a-Si:H appear to be high index coating materials, but were not damage tested. The reactive sputtering process allows precise control of coating crystalline phase and grain size. For TiO2 both optical properties and damage threshold were related to these materials properties, and glassy coatings shown to be optimal. S.F.

N81-10396# Optical Coating Lab., Inc., Santa Rosa, Calif.
RECENT DAMAGE RESULTS ON SILICA/TITANIA REFLECTORS AT 1 MICRON
C. K. Carniglia, Joseph H. Apfel, T. H. Allen, Trudy A. Tuttle, W. H. Lowedermilk (California Univ., Livermore. Lawrence Livermore Lab.), D. Milam (California Univ., Livermore. Lawrence Livermore Lab.), and F. Rainer *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 377-390 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Laser damage experiments involving 15 layer silica/titania high reflectors are discussed. Damage testing was done using 1 ns laser pulses at 1.06 micrometers. The addition of a halfwave silica overcoat leads to a 50 percent improvement in HR damage threshold. An experiment to modify the electric field intensity distribution within the coating indicates that the determining factor is neither the peak field within the titania layers, nor the average field in the titania layers, but the field at the titania/silica interface. For absorptance values above 100 ppm, there is a strong correlation between damage threshold and absorption. However, for absorptance below 100 ppn, that damage threshold is not related to bulk absorption in the coatings. Optical microscopy supports this conclusion. S.F.

N81-10397# California Univ., Livermore. Lawrence Livermore Lab.
DAMAGE TO COATINGS AND SURFACES BY 1.06 MUm PULSES
W. H. Lowdermilk, D. Milam, and F. Rainer *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 391-403 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Damage thresholds for 1 ns, 1.06 micrometer laser pulses were measured for bare, polished surfaces and thin-film coatings. Substrate material, polishing compounds and processes, coating materials and deposition methods and the effects of absorption, electric-field strength, undercoats, overcoats and surface etching techniques are discussed. S.F.

N81-10398# Air Force Weapons Lab., Kirtland AFB, N. Mex.
PULSED DAMAGE THRESHOLDS OF FLUORIDE AND OXIDE THIN FILMS FROM 0.26 MICRONS TO 1.06 MICRONS Ph.D. Thesis
T. W. Walker, A. H. Guenther, C. G. Fry, and P. Nielson (Air Force Inst. of Technology, Wright-Patterson AFB, Ohio) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 405-415 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The pulsed laser-induced damage threshold for CaF2, MgF2, ThF4, MgO, Al2O3, T1O2, SiO2, HfO2, and ZrO2 thin films is determined. Measurements were made at 1.06, 0.53 and 0.26 microns with pulse lengths of 5 and 15 ns (measured at 1.06 microns). Different film thicknesses of each material were damaged at each wavelength and pulse length. It was found that the pulse length dependence of breakdown fit with a pulse length (1/2) curve for most of the materials. Exeptions were found in some oxide coatings at 1.06 (1/2) where the breakdown energy density was essentially independent of the pulse length. The damage threshold of the fluoride and Sio2 films increased with a decrease in film thickness. This did not correlate with changes in the E field inside the thin films. The breakdown threshold decreased with decreasing wavelength and correlated inversely with the absorption coefficient, although the correlation was not linear. There was a marked change in the damage morphonogy of the materials as wavelength was decreased. At 0.26 microns all the oxide material damaged in a uniform region while the fluorides damaged as isolated pits. The morphology, pulse length, and film thickness trends are discussed in terms of impurity, avalanche ionization, and multiphoton damage models. M.G.

N81-10399# California Univ., Livermore. Lawrence Livermore Lab.
LASER-INDUCED DAMAGE MEASUREMENTS WITH 266-nm PULSES
T. F. Deaton and W. L. Smith *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 417-424 refs (For primary document see N81-10363 01-36)
(Contract W-7405-eng-48)
Avail: NTIS HC A23/MF A01

Results of a survey of laser-induced damage thresholds for optical components at 266-nm are reported. The thresholds were measured at two pulse durations: 0.150 ns and 1.0 ns. The 30 samples tested include four commercial dielectric reflectors, three metallic reflectors, two anti-reflection films, a series of eight half-wave oxide and fluoride films, and twelve bare surfaces (fluoride crystals, silica, sapphire, BK-7 glass, cesium dideuterium arsenate and potassium dihydrogen phosphate). The 266-nm pulses were obtained by frequency-quadrupling a Nd:YAG, glass laser. Equivalent plane imagery and calorimetry were used to

measure the peak fluence of each of the UV pulses with an accuracy of + or - of 15%; the uncertainty in the threshold determinations is typically + or - 30%. M.G.

N81-10400# Raytheon Co., Waltham, Mass. Research Div.
HIGH ENERGY LASER OPTICAL TRAIN PERFORMANCE: A REASSESSMENT
Claude A. Klein *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 425-438 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Problems relating to thermally induced phase aberrations experienced in a power-optics environment are addressed. Specifically, issues of concern in assessing the performance of high energy laser (HEL) systems with regard to focal intensities and on-target fluences, when thermal lensing phenomena do occur in the optical train are discussed. A model was developed that should allow HEL-system designers to complete an evaluation of the degradation in light intensity, which is caused by irradiance-mapping aberrations in the near-field. Perhaps the most important conclusion that was reached is that theories, calculations, and experiments conducted on a single-component basis provide highly unreliable guidelines for passing judgement on the merits of mirror/window material candidates, or their projected performance in an optical train. J.M.S.

N81-10401# Air Force Weapons Lab., Kirtland AFB, N. Mex.
ANALYSIS OF AN IMPERFECTLY COATED CONICAL ELEMENT FOR HIGH ENERGY LASER RESONATORS
W. P. Latham, Jr. *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 439-443 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The scalar field approximation is normally used in the analysis of eigenmodes and eigenvalues for high energy laser resonators. A theory to account for the vector nature of the electromagnetic field when conical elements are used in resonators was developed. When polarization effects are included, an unacceptable mode is shown to exist in a conical-element, annular-gain laser. A special optical coating placed on a conical resonator mirror would make the resonator mode acceptable by introducing a 90 deg phase shift between polarization states which are parallel and perpendicular to the plane of incidence upon reflection at a 45 deg angle of incidence. The analysis for a related resonator within Dente's theory is given. The results indicate the tolerance limits of such a coating for a conical element in a high energy device. J.M.S.

N81-10402# Air Force Weapons Lab., Kirtland AFB, N. Mex.
NONLINEAR ABSORPTION IN DIRECT-GAP CRYSTALS
A. Vaidyanathan, T. W. Walker, A. H. Guenther, J. S. Mitra (Rhode Island Univ., Kingston), and L. M. Narducci (Drexel Univ., Philadelphia) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 445-455 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

A critical review of the Keldysh, Braunstein, and Basov formulations of the nonlinear absorption process in direct gap crystalline solids is presented. The two photon absorption coefficients in several alkali halides and semiconductors are calculated by means of the above three models and compared with available experimental data. It is concluded that the Keldysh formula offers a sufficiently accurate description of the multiphoton absorption process, even when the photon multiplicity is small. This is in contrast to the frequently expressed view that the Keldysh formula is incorrect for small photon multiplicities. It is found that the Keldysh formula is closely related to Braunstein's formula for allowed-allowed transitions, while Basov's formula corresponds to the allowed-forbidden case. It is also shown that the predictive accuracy of the Braunstein formulas can be increased by the use of nonparabolic energy bands and excitonic intermediate states. Finally, the Basov formula, which until now was considered to be the most accurate description of the two photon absorption process, is shown to contain several errors. Author

N81-10403# Air Force Weapons Lab., Kirtland AFB, N. Mex.
COMPETING MECHANISMS IN LASER-INDUCED DAMAGE
A. Vaidyanathan, T. W. Walker, and A. H. Guenther *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 457-465 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The thresholds for laser induced intrinsic damage in several alkali halide crystals are calculated by means of separate avalanche and multiphoton ionization models, as well as by a combination of the two. It is found that, in general, the avalanche mechanism yields damaging optoelectric field strengths in good agreement with the experimentally measured values. The field strengths required for damage solely due to multiphoton ionization are substantially higher. However, when the photon multiplicity is less than or equal to four, the damage fields predicted by the multiphoton model are often smaller than those calculated for catastrophic avalanche multiplication, and are in better agreement with the experimentally measured damage thresholds. Furthermore, it is noted that neither the avalanche nor the multiphoton ionization model, when considered alone, can satisfactorily explain the experimentally observed frequency and pulse length dependence of the damage fields over the entire reported range of these parameters. J.M.S.

N81-10404# Pacific-Sierra Research Corp., Santa Monica, Calif.
THEORY OF ELECTRON-AVALANCHE BREAKDOWN IN SOLIDS
M. Sparks, T. Holstein, R. Warren, D. L. Mills, A. A. Maradudin, L. J. Sham, E. Loh, Jr., and F. King *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 467-478 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Electron avalanche breakdown in solids is explained by a theory that is predictive and agrees with experimental results for the magnitude of the breakdown field and its temperature dependence, pulse curation dependence, material to material variation, and wavelength dependence. The good agreement between experiment and theory with no parameters adjusted is obtained by using improved magnitudes and energy dependences of the electron phonon relaxation frequencies. The contributions of both optical and acoustical phonons to electron loss and diffusion must be included. The breakdown field E sub B is calculated by solving an eigenvalue equation obtained from the diffusion transport equation. Simple models and interpretations of the diffusion equation afford physical insight into breakdown and render the breakdown conditions predictable. Preliminary results indicate that the diffusion approximation fails for wavelengths considerably shorter than 1 microns, but that E sub B decreases with decreasing lambda as a result of multiphoton absorption before the diffusion approximation fails. J.M.S.

N81-10405# Air Force Weapons Lab., Kirtland AFB, N. Mex.
IMPURITY BREAKDOWN MODEL IN THIN FILMS
Ph.D. Thesis
T. W. Walker, A. Vaidyanathan, A. H. Guenther, and P. Nielsen (Air Force Inst. of Technology, Wright-Patterson AFB, Ohio) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 479-496 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

An impurity model for breakdown was examined. The case for nonmetallic impurities was derived from the thermal equations. These equations were then compared to an exact solution in which it is not assumed that the radial temperature distribution within the particle is a constant. It was found that the exact solution does not agree with the approximate solutions when the thermal conductivity of the impurity is small. In this case, the temperature in the particle is not uniform and the damage threshold can be substantially lower. The Mie absorption coefficient was then combined with the exact solution. For nonmetallic impurities the results predict a damage threshold which depends on the film thickness. The experimental results for CaF2, ThF4, and NgF2 were found to agree very well with these theoretical predictions. This agreement was found to hold at both the 5 ns pulse lengths and at 1.06 microns, 0.53 microns, and 0.26 microns wavelengths. Further theoretical calculations show that different size impurities are the most damage sensitive at different pulse lengths (and wavelengths). The calculation of breakdown threshold as a function of pulse length for fused silica surfaces fit very accurately. J.M.S.

N81-10406# *Naval Weapons Center, China Lake, Calif.*
FREQUENCY AND FOCAL VOLUME DEPENDENCE OF LASER-INDUCED BREAKDOWN IN WIDE BAND GAP INSULATORS
M. J. Soileau, M. Bass (University of Southern California, Los Angeles), and P. H. Klein (NRL) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 497-517 refs Sponsored in part by ONR (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The frequency and focal volume dependence of the laser induced breakdown fields of selected wide band gap insulators were investigated. Measurements were conducted with pulsed (31 to 140 nsec), simple spatial mode lasers at wavelengths of 10.6, 3.8, 2.7, and 1.06 microns. The results indicate that multiphoton assisted electron avalanche breakdown is a likely mechanism for laser induced failure in these materials over the wavelength range studied. For small focal volumes, volumes smaller than the inverse of the free electron density, the frequency dependence of breakdown is determined by multiphoton ionization of impurity levels. This initiates an avalanche and leads to the observation that breakdown fields decrease with increased laser frequency. For large focal volumes, the free electrons initially present in the crystal initiate the breakdown, and the frequency dependence is determined by the electron phonon relaxation time. Thus, for large focal volumes, the laser induced breakdown fields increase with increasing laser frequency. From these results it is clear that crystal defects and impurities play an important role in what has been called 'intrinsic' damage. J.M.S.

N81-10407# Academy of Sciences of the Lithuanian SSR, Vilnius.
SBS INFLUENCE ON LASER DAMAGE OF OPTICAL MATERIALS
P. Balkevicims, E. Kosenko, J. Lukosius, and E. Maldutis *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 519-527 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

The influence of the stimulated Brilloin scattering (SBS) on the damage of optical materials was experimentaly investigated. It is shown that depending on the experimental conditions, the SBS changes the threshold and the bulk damage character. It can decrease or increase the magnitude of the threshold power of the laser beam, which damages the surface of the optical systems. The SBS increases (the increase of more than 100 times has been registered), but not decreases the threshold power of the bulk damage, as it was thought earlier. It is shown, that the reason of the decrease of the bulk damage threshold and the changes of the damage thresholds of the surface of the optical system is a redistribution of the laser beam intensity caused by the SBS, which decreases the intensity in the focal region of lens. The influence of the laser beam redistribution on the damage thresholds and self-focusing is also discussed. J.M.S.

N81-10408# National Research Council of Canada, Ottawa (Ontario).
COMPUTER SIMULATION OF DAMAGE MORPHOLOGY
P. Kelly, D. Ritchie, A. Schmid (Washington State Univ.), and P. Braeunlich (Washington State Univ.) *In* NBS Laser Induced Damage in Opt. Mater. Jul. 1980 p 529-530 refs (For primary document see N81-10363 01-36)
Avail: NTIS HC A23/MF A01

Progress to date on the computer simulation of the spatio-temporal behavior of a fast, just damaging pulse focused into an optical material is illustrated. The code PULSE is intended to be sufficiently flexible to accommodate any flux, wavelength, material or temperature dependence of the dielectric function and any possible mechanism of electronic excitation of the solid (avalanche, multiphoton generation, etc.), as well as various conceivable mechanisms for converting the energy of the photon field to excited electron and phonon distributions with an ultimate increase in lattice temperature. At last year's symposium (3) we presented an adaption of the computer code RAMES to the problem of damage in solids. We now consider a significant modification of that work: namely, the grid is now placed on the solid (over the interaction volume) and the pulse propagates through it. Denoting the total energy for intrisic damage, the effect of varying the energy content of a clipped gaussian pulse is illustrated. Finally, the history of the ionization fraction, in this case, the number of polarons created, is shown. Close to the center of the interaction volume this fraction reaches 0.0005. J.M.S.

N81-10409# Naval Postgraduate School, Monterey, Calif.
STARK CELL STABILIZATION OF A CO2 LASER M.S. Thesis
Larry Edward Knolhoff Mar. 1980 115 p refs
(AD-A089286) Avail: NTIS HC A06/MF A01 CSCL 20/5

Studies have been conducted of the frequency stabilization of the output from a Sylvania 941 Carbon Dioxide laser by active comparison with a Stark-tuned NH2D line center in an absorption cell. A dithered Stark voltage gave a peak-detection correction signal fed back to a PZT mounted laser resonator mirror to control the cavity optical length. Operation of an integrator incorporated in the feedback loop to improve the system stability has been investigated. A method was demonstrated of using the integrator to locate the desired laser vibronic transition by scanning the laser through its spectral signature prior to initiation of servo operation. An unexpected discontinuity in the absorption lineshape of a Stark-tunable cell was discovered which made the cell unsuitable for generation of the feedback signal. A new and more versatile Stark cell was designed for test and evaluation of cell plate configuration and fabrication. GRA

N81-10410# *Naval Research Lab., Washington, D. C.*
HIGH-POWER PICOSECOND PHOTOLYSIS OF SIMPLE ORGANIC MOLECULAR GASES
B. B. Craig, W. L. Faust, L. S. Goldberg, J. M. Schnur, and P. E. Schoen 11 Sep. 1980 14 p refs
(AD-A089267) Avail: NTIS HC A02/MF A01 CSCL 20/5

High-power picosecond UV pulses from a Nd:YAG mode-locked laser were used to induce a visible emission from a variety of gaseous organic molecules. We report the observation of electronically excited C2, CH, CN and H fragments. The spectral characteristics and time development of the emitting species are highly dependent upon the structure of the parent molecules. GRA

N81-10411# *Physical Sciences, Inc., Woburn, Mass.*
ANALYSIS OF LASER-TARGET INTERACTION. VOLUME 1: THEORY Final Report, 16 Dec. 1977 - 15 Dec. 1978
R. G. Root, A. N. Pirri, P. K. S. Wu, and H. Gelman Mar. 1979 436 p refs
(Contract DAAK40-78-C-0010)
(AD-A089211; PSI-TR-170A-Vol-1) Avail: NTIS HC A19/MF A01 CSCL 20/5

Pulsed laser interaction with metals is examined as well as the interaction of repetitively pulsed 10.6 micron m lasers with dome materials and the first order concept in the hardening of materials by repeatedly pulsed radiation. Theoretical models are discussed for central thermal coupling to Al2024 targets via plasma reradiation and are extended to include other metal targets such as SS304, steel 4130 and Ti6Al4V. The theory predicts substantial thermal and mechanical coupling at large angles of incidence. Theoretical models are also advanced for the surface interaction of a pulsed laser with dome material and for repetitive damage to fiberglass, based on delamination and the concept of maximum amount of residual energy. A variety of potential hardening schemes is presented and analyzed. Several attractive hardening approaches are identified. A.R.H.

N81-10412# *Air Force Systems Command, Wright-Patterson* AFB, Ohio. Foreign Technology Div.
A THERMODYNAMIC MODEL FOR CO2 LASERS
D. C. Dumitras 8 Aug. 1980 32 p refs Transl. into ENGLISH from Studii si Cercetari de Fiz., (Romania), Vol. 30, No. 7, 1978 p 671-694
(AD-A089447; FTD-ID(RS)T-1023-89) Avail: NTIS HC A03/MF A01 CSCL 20/5

The dependence of the small signal gain as a function of a number of parameters is calculated to optimize the functioning of a CO2 laser with waveguide. The main limitation of works dealing with thermodynamic models for CO2 lasers is shown to be using calculated excitation and relaxation rates which can differ appreciably from the measured ones. The model used for lasers with waveguide is presented. It can be used also for other CO2 lasers with axial discharge and gas flow. For lasers

without gas flow, the modifications of the rate equations are due to the kinetic temperature of the gas and eventual gaseous components which participate in the inversion in the CO2 molecule (especially the carbon monoxide). R.K.G.

N81-10413# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

EXPERIMENTAL STUDIES OF ANNULAR (HSURIA) RESONATORS INCLUDING POLARIZATION EFFECTS

R. A. Chodzko, S. B. Mason, and E. B. Turner 15 Aug. 1980 58 p refs Prepared for AFWL

(Contract F04701-79-C-0080)

(AD-A089614; TR-0080; SD-TR-80-51) Avail: NTIS HC A04/MF A01 CSCL 20/5

A repetitively pulsed CO2 laser facility was developed for testing annular resonators. The large-aperture device exhibits generally uniform gain over an annular region of 18-cm outer and 10-centimeter inner diameter. The half-symmetric unstable resonator with internal axicon (HSURIA) was tested at equivalent Fresnel numbers up to 4.5. This resonator design incorporates a W-axicon mirror beam compactor that transforms a cylindrical mode region into an annular mode region. Two HSURIA configurations were evaluated (1) with a rear conical mirror and (2) with a rear flat mirror in the annular leg. GRA

N81-10414# Rochester Univ., N. Y. Dept. of Chemistry.

LASER INTERACTION WITH THE END ATOMS OF A LINEAR CHAIN

William C. Murphy and Thomas F. George Aug. 1980 16 p refs

(Contracts N00014-80-C-0472; F49620-78-C-0005)

(AD-A089584; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07/4

The effects of laser radiation on a one dimensional linear system are examined using classical mechanics. Laser induced desorption of oxygen from silicon and hydrogen from lead are studied in detail. GRA

N81-10415# Rochester Univ., N. Y. Dept. of Chemistry.

MULTIPHOTON-MULTIPHONON THEORY OF LASER-STIMULATED SURFACE PROCESSES Interim Technical Report

Jui-Teng Lin, A. C. Beri, Michael Hutchinson, William C. Murphy, and Thomas F. George Aug. 1980 21 p refs Submitted for publication

(Contract N00014-80-C-0472; NR Proj. 056-749)

(AD-A089583; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

A theoretical model for multiphoton laser-excitation and multiphonon T1 and phase T2 relaxation of molecules adsorbed on a solid surface is developed. The ensemble-averaged excitation number for the infrared-active adspecies is obtained within a Heisenberg-Markovian approximation. The selective nonthermal excitation is sensitive to the mass ratio of the surface atoms and the adspecies, the order of the multiphonon excitation and the duration of the laser pulse. GRA

N81-10416# Cincinnati Univ., Ohio. Inst. of Materials Science.

ELECTRON BEAM/LASER GLAZING OF IRON-BASE MATERIALS Annual Progress Report

Peter R. Strutt Jul. 1980 76 p refs

(Contract N00014-78-C-0580)

(AD-A089631) Avail: NTIS HC A05/MF A01 CSCL 20/7

The development of a programmable scanning system on an electron beam surface melting unit makes it possible to produce a rapidly quenched surface layer on a substrate material. This capability facilitates a fuller characterization of electron beam 'glazing' hard iron-base materials which include M2 tool steel and several alloyed steels dispersion strengthened with titanium carbides particles. These latter materials following 'glazing' treatment exhibit ultra-refinement of the microstructure and microhardness values well in excess of those normally obtained. Preliminary sliding/impact wear studies indicate that relatively thin (approximately 50 micrometers) 'glazed layers' reduce surface erosion, however, isolated cracks form at periodic intervals across the surface. Finally, in a high carbon/low alloy steel 'laser-glazing' and 'E.B.-glazing' produced, in some instances, strikingly different microstructures and correspondingly different microhardness values. It is proposed that the nature of the 'glazing' atmosphere contributes to this effect. The results are consistently interpreted on the basis of the nucleation of martensite by either small oxide or carbide particles. GRA

N81-10417# Arizona Univ., Tucson. Optical Sciences Center.

OPTICS FOR LASER RADAR CROSS-SECTION MEASUREMENTS Final Report, 1 May 1975 - 31 Jul. 1978

William L. Wolfe and Mitchell C. Ruda Oct. 1979 102 p

(Contract DAAH01-75-C-0912)

(AD-A089482) Avail: NTIS HC A06/MF A01 CSCL 17/8

The laser radar simulator optical design is described. The profile of the mirror surfaces is described in detail. Two test arrangements for analyzing the optical system were set up. These were termed the parent and system tests. These tests and the resulting test results are discussed in the text. The parent test was simply a test of the optical system before the aspheric sections of the secondary and tertiary mirrors were cored out. The system test was a test of the finished optical components in their mounts. The results of these two tests indicated that no appreciable change occurred in the optics due to the coring and both the parent and system tests show that the optical system is performing within the required tolerances. Finally, a detailed step-by-step alignment procedure for the optics is given. GRA

N81-10418# Acton Research Corp., Mass.

KRYPTON FLUORIDE LASER MIRROR STUDY Final Report, Oct. 1978 - Nov. 1979

B. K. Flint, A. Najmi, and L. A. Stelmack Dec. 1979 33 p

(Contract DE-AC08-78DP-40001)

(DOE/DP-40001/1) Avail: NTIS HC A03/MF A01

Rare gas halide lasers at 193 and 248/nm require lower loss optics if mirrors and windows are not to be limiting factors in advanced applications in laser fusion and photochemistry. The process of making UV laser mirrors and the experimental strategy for attempting to improve them is described. Materials research is essential, and included selection and deposition of several candidate materials and an approximate ranking of their optical properties, so that new material combinations could be chosen, computer simulated, and deposited using improved vacuum techniques. Analysis of the electric fields within a laser mirror were employed to lower coating loss. A summary of test data is included, along with remarks on the survivability of UV laser optics, and possible future areas of inquiry, if truly low-loss UV laser mirrors are to ever be developed. DOE

N81-10419# Atomic Weapons Research Establishment, Aldermaston (England).

A MULTIPLE PULSE CO2 TEA LASER FOR USE IN THERMAL BLOOMING STUDIES

T. D. J. Cameron, J. A. McMordie, and R. J. Prosser London Mar. 1980 17 p refs

(AWRE-O-6/80; BR73030; ISBN-0-85518-138-9) Avail: NTIS HC A02/MF A01; HMSO £1 PHI

The design, performance and operating characteristics of a multiple pulse CO2 TEA laser for use in thermal blooming studies are described. Using unstable resonator optics at the maximum pulse repetition frequency of 10.4 Hz, this laser yielded a good quality output beam of mean power 28 2 W. The cathode and anode were both constructed from aluminum alloy. In order to obtain the highest possible homogeneity of the lasing medium in the discharge volume, the glass insulated trigger rods associated with this type of laser were mounted in grooves milled in the cathode perpendicular to the optic axis, rather than parallel which is the normal method. The electrodes are mounted in a box containing a large reservoir of gas which is circulated continuously through the discharge medium to sweep contaminants from the electrode volume. Author (ESA)

N81-10420# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Munich (West Germany). Inst. fuer Festkoeppertechnologie.

MATERIALS QUALITY INVESTIGATION FOR HETERO LASER DIODES Final Report

Herbert Reichl and Juergen Mueller Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 98 p refs In GERMAN;

ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-162) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20,60

A method is described for determining minority carrier lifetimes in the active region of a double hetero laser diode. Lifetimes in the 5 to 9 nanosecond range were determined together with diffusion lengths of between 4.5 and 7 microns. Trap levels of between 0.9 and 1.3 eV were measured. A degredation dependent rise in photocapacity was observed. The Al profile in the diode's active region was determined from the Al (p, gamma) Si reaction. Author (ESA)

N81-10421# National Technical Information Service, Springfield, Va.
GAS DYNAMIC LASERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
Brian Carrigan Jul. 1980 264 p Supersedes NTIS/PS-79/0839: NTIS/PS-78/0829
(PB80-812928; NTIS/PS-79/0839; NTIS/PS-78/0829) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

The citations cover research on kinetic and energy transfer processes, design, optics, nozzles, and performance of gas and chemical lasers relying on gas dynamic effects for lasing enhancement. Diffusion and flow studies specifically applicable to such lasers are also included. This updated bibliography contains 253 citations, 6 of which are new entries to the previous edition. DOE

N81-10422# National Technical Information Service, Springfield, Va.
NEODYMIUM YAG LASERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
Brian Carrigan Jul. 1980 186 p Supersedes NTIS/PS-79/0883: NTIS/PS-78/0808
(PB80-813223; NTIS/PS-79/0883; NTIS/PS-78/0808) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

Federally funded research reports on lasing of neodymium doped yttrium aluminum garnet are cited. Studies on design, fabrication, quantum efficiency, light pulses, stabilization, and testing are covered. Optical pumping, mode locking, frequency conversion, and modulation of these lasers are discussed. Laser applications such as optical communication, range finding, and tracking are included. Safety hazards and radiation damage related to neodymium YAG lasers are also covered. This updated bibliography contains 181 citations, 15 of which are new entries to the previous edition. GRA

N81-10423# New England Research Application Center, Storrs, Conn.
DOUBLE HETEROSTRUCTURE USED IN DIODE LASERS AND LIGHT EMITTING DIODES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1972 - Apr. 1980
C. Gilbert Young May 1980 132 p Sponsored in part by NTIS
(PB80-808900) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

The use of a double heterostructure or double heterojunction in the construction of semiconductor lasers and light emitting diodes (LEDs), is detailed in 138 cited abstracts. Crystal growth and doping, fabrication methods, overall laser or LED design and construction, and performance data are presented for a variety of double heterostructure devices. Numerous applications are described. GRA

N81-10424*# New England Research Application Center, Storrs, Conn.
DOUBLE HETEROSTRUCTURE USED IN DIODE LASERS AND LIGHT EMITTING DIODES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1972 - Apr. 1980
C. Gilbert Young May 1980 114 p Sponsored by NASA and NTIS
(NASA-CR-163654; PB80-808892) Avail: NTIS HC $30.00/MF $30.00 CSCL 20E

The use of a double heterostructure, or double heterojunction, in the construction of semiconductor lasers and light emitting diodes (LEDs), is detailed in 121 cited abstracts. Crystal growth and doping, fabrication methods, overall laser or LED design and construction, and performance data are presented for a variety of double heterostructure devices. Numerous applications are described. GRA

N81-10425# Laser Analytics, Inc., Bedford, Mass.
***A TUNABLE DIODE LASER STACK MONITOR FOR* SULFURIC ACID VAPOR Final Report, Sep. 1978 - Mar. 1980**
Edwin F. Person and Arlan W. Mantz 1979 72 p refs
(Contract EPA-68-02-2990)
(PB80-202690; EPA-600/2-80-174) Avail: NTIS HC A04/MF A01 CSCL 14B

A field prototype instrument for continuous in situ monitoring of sulfuric acid vapor in industrial smoke stacks was developed. The method of detection is dual wavelength differential absorption in the infrared. Two tunable diode lasers are locked to two specific frequencies that provide analytical and background absorption information. The difference between the analytical and background absorption yields the net absorption due to sulfuric acid. Calibration of the monitor depends upon a precise determination of the differential absorption coefficient for the analytical and background frequencies. The monitoring system was field tested at a 650 MW electrical generation plant burning high sulfur oil of Venezuelan origin. The excess air supplied to the boiler combustion chamber was varied from 0.5 to 1.5 percent. Measured baseline concentration of sulfuric acid ranged from 3 to 15 ppm. As the excess air was stepped up from 0.5 to 1.5 percent, the average measured increase in concentration was 39 ppm. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-10426 Connecticut Univ., Storrs.
A TIME-DEPENDENT THEORY OF SPARK IGNITION Ph.D. Thesis
Henry George Adelman 1979 183 p
Avail: Univ. Microfilms Order No. 8025337

For ignition, the spark kernel of hot bubble gas created by the spark must grow to a critical size before its expansion velocity falls below a critical value. A model of spark kernel growth was developed which related the time varying energy input to the kernel expansion in the high pressure region behind a strong shock wave or in an ambient pressure environment behind a weak shock. The strong shock kernel growth model was developed from a simulation of a time dependent energy release in an ideal gas without transport effects which was modified to reflect real gas behavior. The assumptions that energy losses from the spark kernel due to conduction, radiation or convection were negligible were justified by existing experimental data and observations of spark ignition. Comparisons of observed spark kernel growth patterns and ignition energies with prediction made using this theory showed very good agreement for a wide range of pressures, air-fuel ratios and spark durations for both stagnant and flowing gases. Dissert. Abstr.

N81-10427 Michigan Univ., Ann Arbor.
A MATHEMATICAL MODEL OF THE ROLLING PNEUMATIC TIRE UNDER LOAD Ph.D. Thesis
Ming Loo 1980 150 p
Avail: Univ. Microfilms Order No. 8025719

A structural analog of the pneumatic tire was developed and used to predict the vertical load-deflection characteristics of a standing or rolling tire on a flat or cylindrical surface and the tire's free rolling resistance. Experimental verification of the model's performance characteristics was conducted on three similar size tires of different carcass constructions; namely, the bias-ply tire, the bias-belted tire and the radial tire. Results for the tires' vertical load deflection characteristics show close correlation between predicted and experimental values for a wide range of tire inflation pressures. Comparison of the tires' predicted cold rolling resistance characteristics with available experimental

data also show good agreement for the bias-ply tire and the bias-belted tire. A consistently lower value of rolling resistance, however, was predicted for the radial tire, indicating that other modes of energy dissipation unaccounted for by the present model contribute to a larger extent in this case. Dissert. Abstr.

N81-10428 Michigan Univ., Ann Arbor.
OPTIMAL DESIGN FOR ELASTIC BODIES IN CONTACT Ph.D. Thesis
Robert Leon Benedict 1980 109 p
Avail: Univ. Microfilms Order No. 8025650

Two classes of design problems are investigated for frictionless contact between two elastic bodies. The first class involves the design of shape proportions of one body to achieve maximum stiffness. The second class is to predict the initial gap between the bodies such that the maximum contact stress is minimized. A form of contact problem statement suited to formulation of the design problems is obtained by appending the nonpenetration constraint to the energy functional. Based on the functional obtained in this way, the design problems are expressed in isoperimetric form. Necessary conditions are presented for both design problems. Numerical examples of both problems are displayed. Dissert. Abstr.

N81-10429 Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Thermique Appliquee.
TRANSPORT PHENOMENA IN LABYRINTH GLANDS OF TURBOMACHINES Ph.D. Thesis
Tahsin Boyman 1979 104 p refs In FRENCH; ENGLISH summary
(EPFL-ITA-7; ISBN-3-260-04738-7) Avail: Issuing Activity

The mechanisms leading to the transport of contaminating fluid were studied. Straight through type labyrinth glands with moving fins and a stationary outer cylinder were also investigated. Measurements performed with a laser Doppler anemometer showed that transport is mainly due to turbulence originating from rotation of the fins. Theoretical considerations on contamination suspensions indicate that undesired transport occurs only through very small particles (or droplets) with diameters of less than 10 to the minus 6th power and cannot be distinguished from turbulent diffusion. The influence of kinematic and geometrical parameters on the dimensionless mass transport number St sub M was also investigated. Author (ESA)

N81-10430# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AN EVALUATION OF THE USEFULNESS OF TWO MATH MODELS FOR PREDICTING PERFORMANCE OF A 100 MM BORE ANGULAR CONTACT, HIGHSPEED, THRUST BEARING Final Technical Report, May 1977 - Dec. 1978
Dale R. Schulze Apr. 1980 97 p refs
(AF Proj. 3048)
(AD-A089161; AFWAL-TR-80-2007) Avail: NTIS HC A05/MF A01 CSCL 21/5

New designs for mainshaft thrust bearings for gas turbine engines are derived from mathematical and experimental analyses. The predictions of two bearing computer models, DREB and SHABERTH, being used by the Aero Propulsion Laboratory, were compared to experimental data generated by this study. This test bearing was a 100 mm bore, angular contact, ball bearing which was designed for R D. Overall, the SHABERTH model was found to be a more practical tool for preliminary bearing design. However, DREB showed promise of being a valuable tool for diagnosing the dynamics of the bearing cage. This study also presents a new method for measuring three dimensional kinematics of the bearing cage. A bibliography of the pertinent literature is included. GRA

N81-10431# Varo, Inc., Garland, Tex.
GENERATOR EXHAUST SIGNATURE SUPPRESSION (GESS) SYSTEM MOUNTING ADAPTERS FOR THE 15 Kw AND 30 Kw DOD DIESEL ENGINE GENERATORS Final Report
Robert E. Wallace Jun. 1980 43 p
(Contract DAAK70-79-C-0207; DA Proj. 1X4-64307-D-212)
(AD-A089298; TD-75297) Avail: NTIS HC A03/MF A01 CSCL 10/2

This development was for 2 adapters to allow mounting of the Generator Exhaust Signature Suppression System (GESS) duct to 15 kw and 30 kw diesel driven generators. Adapters are mountable on these generators without any modification to the generators except removal of 13 bolts and the weather cap. Use of both adapters mounts the GESS duct in a horizontal attitude so that no hot parts of the duct are seen above a horizontal plane through the duct. GRA

N81-10432# Mechanical Technology, Inc., Latham, N. Y. Research and Development Div.
DEVELOPMENT OF LOW-FRICTION ELASTOMERS FOR STERN-TUBE BEARINGS Final Report, 1 Oct. 1979 - 31 Jul. 1980
Bharat Bhushan 31 Jul. 1980 63 p refs
(Contract N00014-79-C-0041)
(AD-A089682; MTI-80TR44) Avail: NTIS HC A04/MF A01 CSCL 11/9

The objective of the program was to develop lubricant-filled nitrile rubber to obtain low friction and possibly low wear for seawater-lubricated sliding applications. Limited work has been done in industry on adding solid and/or liquid lubricants to the elastomers during compounding. Not much data have been published due to the proprietary nature of the work; but, based on what has been published and discussions with experts in the lubrication field, it is believed that no systematic study had previously been undertaken. This is probably the first systematic study to discover what has been done in the field and to further develop lubricant-filled elastomers. The base elastomer selected was butadiene acrylonitrile copolymer (per MIL-B-17901, Class 1). Two lubricant approaches were taken. First, an incompatible and lubricating oil was added in the elastomer during compounding. As a result of aging, these oils migrate to the surface and continuously provide a lubricant film. In another approach, the solid lubricant particles were added during compounding. As the elastomer wears, it will expose newer solid-lubricant particles. The following solid lubricants were selected: MoS2, graphite, cadmium oxide-graphite-silver, and other proprietary additives. The fillers ranged in quantity from 5% to 20% by weight. The compositions were made by three experienced molders based on MTI's recommendations. GRA

N81-10433# Westinghouse Electric Corp., Tampa, Fla.
DEVELOPMENT OF AUTOMATED WELDING PROCESS FOR FIELD FABRICATION OF THICK WALLED PRESSURE VESSELS, FY 1980 Technical Progress Report, period ending 28 Mar. 1980
U. A. Schneider 1980 72 p
(Contract DE-AC01-78ET-13511)
(DOE/ET-13511/T2) Avail: NTIS HC A04/MF A01

Specifications of 2 1/4 chromium-1 molybdenum low alloy steel plate for a coal gasification project are discussed along with methods of welding and analyses of helium argon mixtures for welding. The tensile properties of welded joints are also examined. DOE

N81-10434# Westinghouse Research and Development Center, Pittsburgh, Pa.
SURVEY OF WELDING PROCESSES FOR FIELD FABRICATION OF 2 1/4 Cr-1 Mo STEEL PRESSURE VESSELS
G. E. Grotke Apr. 1980 106 p refs
(Contract DE-AC01-78ET-13511; EF-78-C-01-2771)
(DOE/ET-13511/T1) Avail: NTIS HC A06/MF A01

Any evaluation of fabrication methods for massive pressure vessels must consider several welding processes with potential for heavy-section applications. These include submerged arc and shielded metal arc, narrow joint modifications of inert gas metal arc and inert gas tungsten arc processes, electroslag, and electron beam. The advantage and disadvantages of each are discussed. DOE

N81-10435# TRW Energy Systems Group, Morgantown, W. Va.
VALVE TECHNOLOGY DEVELOPMENT AT THE MORGANTOWN ENERGY TECHNOLOGY CENTER
Nov. 1979 87 p
(Contract DEAM21-78MC-08496)
(DOE/METC/SP-80/1) Avail: NTIS HC A05/MF A01

During development of second and third generation coal

conversion and utilization processes, a recurrent problem was manifested - valve failures. The valve failures are typically caused by erosion, jamming, or other solids handling related problems. Redundant loops to allow on-stream valve maintenance and replacement, process redesign to locate valves in a less severe environment, use of sacrificial valves, and other means to try to eliminate valving were tried. Most of these techniques are expensive, inconvenient, and detrimenal to the process. The proposed solution is to: define requirements for valve service that encompass the most promising coal conversion process; obtain input from valve users; survey the valve industry to determine the availability of valves to satisfy the requirements; test available valves to ensure their adequacy; and develop new valves for applications where existing valves are inadequate.

N81-10436# National Gas Turbine Establishment, Farnborough (England).

A METHOD OF PERFORMANCE PREDICTION FOR CENTRIFUGAL COMPRESSORS. PART 1: ANALYSIS. PART 2: COMPARISON WITH EXPERIMENT

M. V. Herbert London Feb. 1980 175 p refs Supersedes NGTE-M78029; ARC-38052; NGTE-M78031; ARC-38053 (ARC-R/M-3843; BR73151; NGTE-M78029; ARC-38052; NGTE-M78031; ARC-38053) Avail: NTIS HC A08/MF A01; HMSO £18 PHI

A method was developed capable of producing reasonably accurate stage characteristics, in terms of mass flow, pressure ratio, work input and efficiency, for any centrifugal compressor with radial outflow (i.e., with no axial component of velocity at outlet), given only overall geometric properties. The analytical treatment and assumptions used are presented along with the results of applying the method to various machines and comparison of the predictions with test data. Prediction of choking flow is generally satisfactory, and the mass flow/pressure ratio characteristics produced have substantially correct form, although no general means have been found of predicting the onset of surge. For the cases examined the error in predicted efficiency level is within 1 to 2 percent at design speed, sometimes more at low speed. Author (ESA)

N81-10437# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

INLET FLOW IN CENTRIFUGAL PUMPS AT PARTIAL DELIVERIES

Mete Sen Jun. 1979 9 p In FRENCH; ENGLISH summary Presented at Soc. Hydrotech. de France Session 113 on Comportement Dyn. des Turbomachines Hydrauliques, 20-21 Jun. 1979 Submitted for publication

(VKI-Preprint-1979-16) Avail: NTIS HC A02/MF A01

Pump design parameters influencing swirling reverse flow were investigated. Several impellers were developed and tests were performed to investigate inlet flow characteristics. An important parameter is called the Pump's Critical Delivery which corresponds to the onset of swirling reverse flow at the tip of the blade's leading edge. The results showed uniform aerodynamic hub to tip blade loading to be the most important criterion associated with low critical deliveries. High critical deliveries are obtained with a high aerodynamic blade loading at the tip. Head stability is not related to swirling reversed flow. A relation does, however, exist between shaft power and reverse flow.

Author (ESA)

N81-10438# National Bureau of Standards, Washington, D.C. National Measurement Lab.

CRITICAL MATERIALS AND FABRICATION ISSUES FOR PRESSURE VESSELS, PIPING, PUMPS, AND VALVES Final Report

Jeffrey T. Fong, ed., Ronald C. Dobbyn, ed., and Leonard Mordfin, ed. Jun. 1980 127 p refs Presented at the ASME Symp., San Francisco, 14-15 Aug. 1980

(PB80-201122; NBS-SP-588; LC-80-600094) Avail: NTIS HC A07/MF A01 CSCL 13C

A total of twelve issues on the materials and fabrication aspects of technical problems in the pressure vessels and piping industry were identified. The twelve issues are: (1) The role of engineering judgment and the computer in the management of material property data; (2) Curve fitting vs. modeling for formulating design rules; (3) New material property data; Terminal vs incremental test; (4) Variability of data: Standards for applications; (5) On-line monitoring of critical components to improve reliability; (6) Upgrading welders' skill and educational level: How and why; (7) Reliability of nondestructive evaluation; (8) Characterization of the subjective component of inservice data; (9) Should there be a methodology for failure analysis; (10) Accelerated development of a more rational basis for nonlinear fracture mechanics; (11) Safety factors in Fatigue Design: Arbitrary or Rational; (12) The ASME Code and product liability: Should compliance create a rebuttable presumption of proper design.

GRA

N81-10439# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.

VEHICLE FUEL ECONOMY: TRACK VERSUS DYNAMOMETER

Bruce Grugett Jun. 1980 9 p refs

(PB80-197791; EPA-AA-SDSB-80-8) Avail: NTIS HC A02/MF A01 CSCL 10A

A 1979 Cheverolet Nova was operated over EPA driving cycles on a test track at the Transportation Research Center in Ohio and on a chassis dynamometer at the U.S. Environmental Protection Agency's Motor Vehicle Emission Laboratory in Ann Arbor. The data obtained provide an opportunity to compare road and dynamometer fuel economy. A dynamometer modification which would make the dynamometer fuel economy a more accurate predictor of fuel economy obtained by the vehicle on the road is discussed. GRA

N81-10440# New England Research Application Center, Storrs, Conn.

MAGNETIC BEARINGS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1974 - Apr. 1980

C Gilbert Young May 1980 22 p Sponsored in part by NTIS (PB80-809148) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

The design and applications of magnetic bearings are treated in this retrospective survey from a relatively new field. Quantitative discussions of the dynamic behavior, including stiffness and cross-axis stabilities, are included. This bibliography contains 14 citations. GRA

N81-10441# New England Research Application Center, Storrs, Conn.

AXIAL FLOW COMPRESSORS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1974 - Apr. 1980

Robert Hippler May 1980 217 p Sponsored in part by NTIS (PB80-808603) Avail: NTIS HC $30.00/MF $30.00 CSCL 13G

Various axial flow compressors, used in jet engines, gas turbines, turbo fans, ultra centrifuges, and in other turbo machinery, are treated in these abstracts. Citations center on design, including blades and rotors, and materials, measurements of flow, performance, and applications. This bibliography contains 200 citations. GRA

N81-10442# Fiat Research Center, Turin (Italy).

POTENTIAL OF DIESEL ENGINES, FUELS AND LUBRICATION TECHNOLOGY Final Report

Giorgio Cornetti Mar. 1980 62 p refs

(Contract DOT-TSC-1424)

(PB80-197098; DOT-TSC-NHTSA-79-42; DOT-HS-805241) Avail: NTIS HC A04/MF A01 CSCL 21E

The chemical and physical properties of diesel fuel are reviewed along with their relationships to the fuel economy and emissions of diesel powered automobiles and light trucks. The fuels considered include both conventional and alternative diesel fuels. Additives are surveyed and their impacts on combustion and overall engine performance are discussed. The fuel economy potential of future lubricants is investigated, particularly: (1) upgraded mineral oils; (2) synthetic oils; and (3) colloidal suspension in mineral oils. GRA

N81-10443# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.

CARBON BALANCE AND VOLUMETRIC MEASUREMENTS OF FUEL CONSUMPTION

Terry Newell Apr. 1980 11 p refs

(PB80-200801; EPA-AA-SDSB-80-05) Avail: NTIS HC A02/MF A01 CSCL 13F

A recently completed EPA test program investigated the effects on emissions and fuel consumption of different types and brands of tires. In that program, fuel consumption was measured using both the carbon balance and volumetric methods. The number of tests conducted provided adequate data for a comparison of the results obtained by these different methods. A previously conducted investigation into the differences between carbon balance and volumetric measurements of fuel consumption concluded that a consistent difference exists between them. Fuel consumption measured volumetrically was found to average three percent higher than when measured by the carbon balance method. This report presents another analysis of this question. GRA

N81-10444# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.

AN INVESTIGATION OF THE FUEL ECONOMY EFFECTS OF TIRE RELATED PARAMETERS

Glenn Thompson and Marty Reineman May 1980 35 p refs (PB80-201007; EPA-AA-SDSB-80-9) Avail: NTIS HC A03/MF A01 CSCL 13F

A program was conducted on a test track to determine the fuel consumption effects of radial vs. bias-ply tires, two radial tires from different manufacturers, and increased tire pressure. The program was designed to eliminate ambient effects by running two identical test vehicles simultaneously and alternating the parameter of interest between the two vehicles. Five different tire types were used (including the original equipment manufacturer tires from the vehicles). It was demonstrated that radial tires were six percent more fuel efficient than bias-ply tires; the radial tires from one manufacturer were four percent more fuel efficient than radial tires from a different manufacturer; and radial tires inflated to 28 psig were three percent more fuel efficient than radial tires inflated to 20 psig. It was also determined that laboratory measurements of rolling resistance are good predictors of track fuel consumption. GRA

N81-10227# Joint Publications Research Service, Arlington, Va.

DEVELOPMENT OF NEW VEHICLE ENGINE REPORTED

In its West Europe Rept.: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 16-17 Transl. into ENGLISH from Unsere Umwelt (Vienna), no. 32, 1979 p 28 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

N81-10229# Joint Publications Research Service, Arlington, Va.

CHARACTERISTICS, EFFICIENCY OF MODULAR ENGINES

In its West Europe Rept: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 63-79 refs Transl. into ENGLISH from Ata (Italy), no. 4, Apr. 1979 p 177-184 (For primary document see N81-10223 01-31)
Avail: NTIS HC A05/MF A01

N81-10995# Joint Publications Research Service, Arlington, Va.

JOINING PIPELINES BY HYPERBARIC WELDING

Guy Fleury *In its* West Europe Rept.: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 1-10 Transl. into ENGLISH from Industrie du Petrole (Paris), Jan. - Feb. 1979 p 73-81 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-10445*# Auburn Univ., Ala. Dept. of Agricultural Engineering.

GRAIN QUALITY INSPECTION SYSTEM Final Report, 23 Jan. 1977 - 30 Sep. 1979

Clifford A. Flood, Jr., David P. Singletow, and Sidney N. James 30 Sep. 1979 167 p refs
(Grant NsG-8047)
(NASA-CR-163682) Avail: NTIS HC A08/MF A01 CSCL 14D

A review of grain quality indicators and measurement methods was conducted in order to assess the feasibility of using remote sensing technology to develop a continuous monitoring system for use during grain transfer operations. Most detection methods were found to be too slow or too expensive to be incorporated into the normal inspection procedure of a grain elevator on a continuous basis. Two indicators, moisture content and broken corn and foreign material, show potential for automation and are of an economic value. A microprocessor based system which utilizes commercially available electronic moisture meter was developed and tested. A method for automating BCFM measurement is described. A complete system description is presented along with performance test results. R.K.G.

N81-10446# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

A CONTROLLED EVALUATION OF THE DIFFERENCES BETWEEN TWO APPROACHES TO RELIABILITY INVESTMENT SCREENING M.S. Thesis

Russell M. Genet and John M. Wallace Jun. 1980 73 p refs (AD-A087506; AFIT-LSSR-36-80) Avail: NTIS HC A04/MF A01 CSCL 14/1

There is a continuing concern about the high aircraft support cost and poor availabilities caused by some aeronautical equipments. It is generally accepted that basic research, engineering development, and improvements in fielded equipments should concentrate on high burner types of equipment. This has been countered by the suggestion that the emphasis would be better placed on those equipment types with the highest return on investment. An experiment was conducted, using data from over 20,000 aeronautical equipments, to determine if the high burner and return on investment approaches really emphasize different equipment types. It was found that, in fact, different equipment types were emphasized. The high burner approach emphasized jet engines, radar sets, etc., while the return on investment approach emphasized valves and actuators, fuel gauges, and other mundane but troublesome equipments. These research findings suggest that a change in policy might be appropriate. GRA

N81-10447# Wisconsin Univ. - Madison. Dept. of Statistics.

A NOTE ON A DIFFICULTY INHERENT IN ESTIMATING RELIABILITY FROM STRESS-STRENGTH RELATIONSHIPS Interim Report

Bernard Harris and Andrew P. Soms Aug. 1980 6 p refs (Contracts N00014-79-C-0321; DAAG29-80-C-0041)
(AD-A089652; UWIS-DS-80-614) Avail: NTIS HC A02/MF A01 CSCL 12/1

This note calls attention to a difficulty which arises frequently in the application of stress-strength methods in reliability theory. This difficulty has led to unanticipated catastrophic failures in a number of applications. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-10448 Engineering Sciences Data Unit, London (England).

LOCAL INSTABILITY OF TRUSS CORE SANDWICH PANELS UNDER LONGITUDINAL COMPRESSION

1980 10 p Supersedes ESDU-68038
(ESDU-80010; ESDU-68038; ISBN-0-85679-293-4) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161

Buckling stresses for corrugated truss core sandwich panels

under longitudinal compression over a range of truss geometries and different face plates to core thickness ratios were studied. The results obtained may be applied to aircraft flooring, bulkheads, and structural panels in buildings. The research is limited to panels in which core and face plates are attached discretely or continuously, having core height to pitch ratios or between 0.2 and 1.4, and face plate to core thickness ratios between 1 and 2.
ESDU (GRA)

N81-10449 Virginia Univ., Charlottesville.
ELASTIC STRESS ANALYSIS OF GENERAL PRISMATIC BEAMS Ph.D. Thesis
Steven Del Letwich 1980 220 p
Avail: Univ. Microfilms Order No. 8024053

The development of a numerical methodology for the elastic stress analysis of general prismatic beams is presented. Applied loads include axial force, bending moment, uniform (constant) torsion, constant (transverse) shear, and the rates of change of twisting moment, axial force, and shear. By assuming that the stresses and strains in a beam vary as a quadratic function of the longitudinal coordinate, the formulation expressed in terms of displacement functions is reduced from a three dimensional analysis to a two dimensional one. Numerical solutions are obtained using the finite element of analysis. Dissert. Abstr.

N81-10450 Polytechnic Inst. of New York.
AN APPROXIMATE METHOD FOR SCATTERING IN ELASTODYNAMICS, THE BORN APPROXIMATION Ph.D. Thesis
Lop-Hee Louis Chu 1980 203 p
Avail: Univ. Microfilms Order No. 8025534

A formulation for the scattering of elastic waves by inhomogeneities embedded in an infinite space is presented and an approximate solution procedure in the spirit of Born approximation is introduced. The analysis is for cavity (lined and unlined) and for rigid inclusion (fixed and movable) cases. Both the near and far field solutions and solution for global motion of rigid inclusion are presented. The special cases of anti-plane and in-plane waves in two dimensional space are studied in detail. Dissert. Abstr.

N81-10451 Polytechnic Inst. of New York.
EFFECTS OF STRUCTURAL FLEXIBILITY ON HYDRODYNAMIC FORCES Ph.D. Thesis
Yung-Kuang Chen 1980 107 p
Avail: Univ. Microfilms Order No. 8019392

An analytical procedure was developed for determining the hydrodynamic forces for cylinders heaving in the free surface of a fluid of infinite depth. The effects of structural flexibility was considered, and the solution of the hydroelastic coupled problem was obtained by appealing to the surface integral method (for the fluid) and the finite element method (for the structure). The fluid potential was expressed by means of a Helmholtz surface integral, in which the normal fluid velocity at the fluid structural interface appeared. Upon discretizing the integral equation, and enforcing the velocity continuity condition at the discrete points of the interface, the elastic and inertia properties of the structure were introduced. Dissert. Abstr.

N81-10452 Rochester Univ., N. Y.
SOME INTERNAL STRESS PROBLEMS IN SOLIDS Ph.D. Thesis
Sanboh Lee 1980 131 p
Avail: Univ. Microfilms Order No. 8023935

Diffusion-induced stresses in solids arise from the diffusion of interstitial impurities, or substitutional impurities larger or smaller than the matrix atoms, resulting in a nonuniform concentration distribution, such as P or B diffusing into a single crystal of Si. If the stress is large enough to exceed the yield stress, dislocations may be generated. Such dislocations may be desirable for surface hardening but not for semiconducting properties. The dislocation structure is unstable thermally and mechanically, as well as electrically. Fick's law with constant and equal diffusivity in all directions, volumetric expansion or contraction for the solutes, and linear and isotropic elasticity theory were used to calculate the stresses. Another kind of internal stress is due to the misfit inclusions introduced by transformation or precipitation. The Eshelby method is used to solve the elastic field of homogeneous (same moduli) or inhomogeneous (different moduli) inclusions whose misfit arises from uniform transform strain. An extension of the Eshelby method to non-uniform transformation strains is applied to simple geometric inclusions such as spherical and parallelepiped inclusions.
Dissert. Abstr.

N81-10453 Kansas Univ., Lawrence.
A STUDY OF THE PARAMETRIC STABILITY OF SKEW STIFFENED PLATES USING FINITE ELEMENTS Ph.D. Thesis
Isaac Addo Allotey 1979 468 p
Avail: Univ. Microfilms Order No. 8026722

The determination of parametric resonance regions for a stiffened plate is discussed. The equations of motion from which the parametric resonance regions are derived, are obtained mainly from Hamilton's equation using the principles of Calculus of Variation. Resulting equations of motion are solved by the Ritz or Galerkin method or by perturbation techniques. To be able to handle more complex problems, finite elements are used. For the finite element analysis, parallelogram plate element is created with arbitrarily oriented stiffeners. Element matrices are derived for this element through the use of expressions for the instantaneous total potential energy of the system and the principle of minimum potential energy. Equations of motion are set up from these element matrices from which the instability regions are derived. The behavior of the element in linear analysis, static buckling, natural frequency, and parametric resonance regions is examined by comparing the computed results with existing solutions. Finally, solutions of many examples with unknown solutions are presented in the results. Dissert. Abstr.

N81-10454# Politecnico di Milano (Italy).
EVALUATION OF SECTION PROPERTIES FOR HOLLOW COMPOSITE BEAMS
Vittorio Giavotto, Marco Borri, Luigi Puccinelli, Vittorio Caramaschi (Construzioni Aeronautiche Giovanni Agusta S. P. A. Cascina Costa di Samarate, Italy), and Francesco Mussi (Construzioni Aeronautiche Giovanni Agusta S. P. A. Cascina Costa di Samarate, Italy) 7 Sep. 1979 30 p refs Presented at the Fifth European Rotorcraft and Powered Lift Aircraft Forum, Amsterdam, 4-7 Sep. 1979
(Paper-Nr-35) Avail: NTIS HC A03/MF A01

The plan for the development and the validation of design procedures for composite beam-like structures and structural components is described. Analytical as well as experimental results are reported. The development of the program HANBA (Hollow Anisotropic Beam Analysis) which, based on an original displacement method approach, allows the evaluation of section stiffnesses and stresses is presented. The program works on a finite element idealization of the beam section and computes the stresses from the resultant forces and moments acting on the particular section, as the usual engineer's beam theory. Experimental results mainly concern the identification of elastic properties for composite laminates, at relativevly low stress levels, and the validation of the results of the program HANBA. Analytical results compare very well with experimental ones, the largest differences in section stiffenesses so far evaluated being of the order of 1%. The plan is still going on and future activities are also outlined in the paper. R.K.G.

N81-10455# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
VERIFICATION OF FATIGUE CRACK INITIATION LIFE PREDICTION RESULTS
A. Buch Mar. 1980 56 p refs
(TAE-400) Avail: NTIS HC A04/MF A01

Crack initiation life estimates obtained with the local strain approach (LSA) and with the conventional nominal stress approach (NSA) were compared with experimental results obtained with stress block loading programs and flight simulation gust loading programs. Programs with and without load peaks were used for testing internally notched 2024-T3 sheet specimens with a very small crack propagation phase. Experimental S-N curves obtained for the notched specimens and assumed to be linear in log sigma sub a - log N coordinates were used for calculations with the NASA method. A material strain-life curve, a cyclic strain stress curve and a K sub F value calculated with a two parameter formula were used for life estimations with the LSA

method: Calculations indicated that the life estimates obtained with the K sub F value for R = 0 (pulsating-tension) were more accurate than in the case of K sub F value for R = 1, or in case of using the SCF value in Neuber's notch analysis. The prediction accuracy can be more improved by use of a proper adjustment factor for sufficiently similar loading spectra. Author

N81-10456# National Research Council of Canada, Ottawa (Ontario).
THE SOLUTION OF FRACTURE MECHANICS PROBLEMS EXISTING WITH FINITE ELEMENT PROGRAMS
J. J. Kacprzynski 27 May 1980 71 p refs Presented at TTCP Meeting, Ottawa, Aug. 1980
(LTR-ST-1178) Avail: NTIS HC A04/MF A01

The finite element method is the best method available for the numerical and most of the engineering fracture mechanics problems. The finite elements programs do not give the exact results, they are idealization dependent and in fracture mechanics, dealing with singular stress/displacement fields, the effect of idealization is particularly strong. There is no direct method for the evaluation of the accuracy of the finite element calculation. Intuition or experience may help in the proper idealization of the problem, but it can be verified only by calculation performed with different idealization. In a case of enriched elements, it appears that there is an 'ideal' size (not extremely large or extremely small) for a given fracture problem. R.K.G.

N81-10457# Battelle Columbus Labs., Ohio.
STRUCTURAL ANALYSIS VIA GENERALIZED INTERACTIVE GRAPHICS - STAGING, VOLUME 1 Final Report, 28 Jun. 1976 - Sep. 1979
L. E. Hulbert and N. D. Ghadiali Sep. 1979 28 p
(Contract F33615-76-C-3125; AF Proj. 2401)
(AD-A089380; AFFDL-TR-79-3074-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 13/13

STAGING (STructural Analysis via Generalized INteractive Graphics) has been developed to give engineers an interactive graphics system for constructing and studying finite element models and for reviewing the results of a finite element analysis. Volume I gives an overview of the general capabilities of the STAGING system. GRA

N81-10458# Battelle Columbus Labs., Ohio.
STRUCTURAL ANALYSIS VIA GENERALIZED INTERACTIVE GRAPHICS - STAGING. VOLUME 2: USERS GUIDE Final Report, 28 Jun. 1976 - Sep. 1979
L. E. Hulbert and C. Scofield Wright-Patterson AFB, Ohio AFFDL Sep. 1979 174 p refs
(Contract F33615-76-C-3125; AF Proj. 2401)
(AD-A089381; AFFDL-TR-79-3074-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 13/13

STAGING (STructural Analysis via Generalized INteractive Graphics) has been developed to give engineers an interactive graphics system for constructing and studying finite element models and for reviewing the results of a finite element analysis. Volume II gives datailed instructions on how to use STAGING for finite element analysis. GRA

N81-10459# Battelle Columbus Labs., Ohio.
STRUCTURAL ANALYSIS VIA GENERALIZED INTERACTIVE GRAPHICS - STAGING. VOLUME 3: SYSTEM MANUAL Final Report, 28 Jun. 1976 - Sep. 1979
L. E. Hulbert, N. D. Ghadiali, and F. N. Deobot Wright-Patterson AFB, Ohio AFFDL Sep. 1979 158 p
(Contract F33615-76-C-3125; AF Proj. 2401)
(AD-A089382; AFFDL-TR-79-3074-Vol-3) Avail: NTIS HC A08/MF A01 CSCL 13/13

STAGING(STructural Analysis via Generalized INteractive Graphics) has been developed to give engineers an interactive graphics system for constructing and studying finite element models and for reviewing the results of a finite element analysis. Volume III describes the internal structure of STAGING and details procedures for installation and maintenance of the System on CDC CYBER and 6000 series mainframe computers. GRA

N81-10460# Battelle Columbus Labs., Ohio.
STRUCTURAL ANALYSIS VIA GENERALIZED INTERACTIVE GRAPHICS - STAGING. VOLUME 4: APPENDICES TO SYSTEM MANUAL Final Report, 28 Jun. 1976 - Sep. 1979
L. E. Hulbert and C. Scofield Wright-Patterson AFB, Ohio AFFDL Sep. 1979 158 p
(Contract F33615-76-C-3125; AF Proj. 2401)
(AD-A089383; FFDL-TR-79-3074-Vol-4) Avail: NTIS HC A08/MF A01 CSCL 13/13

STAGING(STructural Analysis via Generalized INteractive Graphics) has been developed to give engineers an interactive graphics system for constructing and studying finite element models and for reviewing the results of a finite element analysis. Volume IV includes appendices to the System Manual (AD-A089 382). These appendices list the various STAGING procedures, loader directives, and cross-referenced tables of all entry names that occur in the STAGING system. GRA

N81-10461# Wisconsin Univ. - Madison. Mathematics Research Center.
A MATHEMATICAL MODEL FOR LINEAR ELASTIC SYSTEMS WITH STRUCTURAL DAMPING Summary Report
G. Chen and D. L. Russell Jun. 1980 32 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grant AF-AFOSR-0018-79)
(AD-A089662; MRC-TSR-2089) Avail: NTIS HC A03/MF A01 CSCL 12/1

From empirical studies, it is known that the natural modes of vibration of elastic systems have damping rates which are roughly proportional to the frequency of vibration. A number of ad hoc models exhibiting behavior of this type have been proposed in the engineering literature but they are not true dynamical systems nor are they very useful for numerical computations. In this paper, we present a model of the form with B, A positive, unbounded, self-adjoint operators on a Hilbert space X, exhibiting the damping behavior just described, which is known as structural damping. Finite dimensional analogs suitable for computation of approximate solutions are also noted. GRA

N81-10462# Wisconsin Univ. - Madison. Mathematics Research Center.
ENERGY CRITERIA FOR FINITE HYPERELASTICITY Summary Report
Reza Malek-Madani Jul. 1980 24 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A089670; MCR-TSR-2097) Avail: NTIS HC A02/MF A01 CSCL 20/11

The equations of hyperelasticity have the special feature that their natural entropy is not a globally convex function. Strict convexity of the entropy function is essential in formulating a physically reasonable entropy criterion for shock waves. In this paper, we show that the natural entropy of the equations of hyperelasticity is uniformly convex when restricted to the shock curves. This fact enables us to prove the equivalence of the entropy criterion and Lax's shock conditions for existence of weak shocks for problems that are genuinely nonlinear. Furthermore, for problems that are not necessarily genuinely nonlinear we study the (generalized) 'E-condition' and show that it is indeed a generalization of the entropy condition. Finally, we consider the viscosity criterion which requires that a motion of a hyperelastic body is the limit of smooth motions of a family of viscoelastic materials. The relationship between the energy criterion, the E-condition, and the viscosity criterion is then discussed. GRA

N81-10463# Northwestern Univ., Evanston, Ill. Technological Inst.
CRITICAL DAMPING IN CERTAIN LINEAR CONTINUOUS DYNAMIC SYSTEMS
D. E. Beskos and B. A. Boley Aug. 1980 29 p refs
(Contract N00014-75-C-1042)
(AD-A089686; TR-1980-2) Avail: NTIS HC A03/MF A01 CSCL 13/13

Free damped vibrations of linear elastic structures composed of uniform beam elements with a continuous distribution of mass are studied. Axial, torsional and flexural vibrations are considered. The amount of damping, which can be either internal or external viscous type, varies among the various beam elements of the structure resulting in many critical damping possibilities. A general method is developed, which, with the aid of dynamic stiffness

influence coefficients defined for every element, determines the 'critical damping surfaces' of the system. These surfaces represent the loci of combinations of amounts of damping leading to critically damped motion and thus separating regions of partial or complete underdamping from those of overdamping. The dimension of a critical damping surface is equal to the number of independent amounts of damping present in the system, while the number of these surfaces is infinite, i.e., equal to the number of degrees of freedom of the system. Three examples are presented in detail to illustrate the proposed method for determining critical damping and demonstrate its importance. GRA

N81-10464# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

CRACK PROPAGATION ALONG CRYSTALLOGRAPHIC SLIP BANDS AND HYDROGEN EMBRITTLEMENT

J. R. Wilcox and D. A. Koss Aug. 1980 11 p refs Presented at the 3rd Intl. Conf. on Effect of Hydrogen on Behavior of Mater., Jackson Lake Lodge, Wyo., 26-31 Aug. 1980

(Contract N00014-76-C-0037; Grant AF-AFOSR-2596-74)

(AD-A089528; TR-14) Avail: NTIS HC A02/MF A01 CSCL 20/11

The propagation of a crack along a crystallographic slip band occurs frequently in alloys susceptible to planar, nonuniform slip. Such crystallographic cracking occurs in large grain or single crystal material and on planes inclined to the stress axis and is most commonly observed under cyclic loading conditions in high strength Ni-, Ap-, and Ti alloys. In all of these materials, cracks propagating along slip bands usually have a substantially brittle or cleavage-like fracture appearance, which can be sensitive to the environment. This suggests that normal stresses and environmental effects are important in this fracture process.GRA

N81-10465# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

GENERALIZED PLANE-STRAIN PROBLEMS IN AN ELASTIC-PLASTIC THICK-WALLED CYLINDER

P. C. T. Chen Jul. 1980 22 p refs Presented at the 26th Conf. of Army Mathematicians, 10-12 Jun. 1980, Hanover, N.H.

(AD-A089647; AD-E440087; ARLCB-TR-80028) Avail: NTIS HC A02/MF A01 CSCL 20/11

A new finite difference approach has been developed for solving the generalized plane strain problems of partially plastic thick walled cylinders made of strain hardening or ideally plastic materials. The tube is assumed to obey the Von Mises criterion, the Prandtl-Reuss flow theory and the isotropic hardening rule. The forces include internal pressure, external pressure, and end force. An incremental approach is used and no iteration is needed for each imcrement. The approach is simpler than others yet quite general and accurate. The desired accuracy can be achieved by reducing the grid sizes and load increments. Some numerical results for the stresses and displacements in partially plastic thick walled cylinders with either open end or closed end conditions are presented. GRA

N81-10466# General Electric Co., Schenectady, N. Y.

BEHAVIOR OF UNIRRADIATED ZIRCONIUM-LINED AND COPPER-PLATED ZIRCALOY-2 TUBING UNDER SIMULATED PCI CONDITIONS

R. P. Gangloff Nov. 1979 105 p refs Prepared for Commonwealth Research Corp.

(Contracts DE-AC02-77QQ-04473; EN-77-C-02-4473)

(GEAP-25093) Avail: NTIS HC A06/MF A01

The expanding mandrel technique was employed to evaluate the fracture resistance of unirradiated, cold worked zirconium and copper barrier fuel cladding for simulated pellet cladding interaction conditions. A range of environment and loading conditions, shown to produce severe embrittlement of cold-worked Zircaloy-2 and including 4 Pal2, pure cadmium, and molten cadmium saturated cesium, was employed for barrier screening. DOE

N81-10467# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Dept.

NUMERICAL BUCKLING ANALYSIS OF A Z-STIFFENED PANEL MODEL WITH THE EXPERIMENTAL METHOD FOKKER (EMF) AND BOSOR4 COMPUTER PROGRAMS

B. H. Bulder 21 Mar. 1979 28 p refs

(FOK-RV-79-33) Avail: NTIS HC A03/MF A01

Results are reported for two numerical buckling analyses to correlate the BOSOR4 R = infinity option, for flat panel buckling, with a manufacturer-developed collapse load code, for a Z-type stringer-skin model. Good correlation was found for general instability. Results are given for elastic buckling load reduction, due to local buckling effects as computed using the manufacturer's procedures. Author (ESA)

N81-10468# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Ruimtevaart.

VIBRATION ISOLATION OF EUROPEAN COMMUNICATIONS SATELLITE (ECS) SOLAR WING

J. J. Wijker 5 Apr. 1979 48 p refs

(FOK-RV-79-34) Avail: NTIS HC A04/MF A01

Dynamic responses of the European Communications Satellite solar wing, due to base excitation, are reduced using the technique of vibration isolation. The resonant frequency of the vibration isolator was set to 3.1 Hz. Above 5 Hz the amplification factors were less than 2.0 in a frequency range to 120 Hz.

Author (ESA)

N81-10469# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Ruimtevaart.

REDUCTION OF EUROPEAN COMMUNICATIONS SATELLITE (ECS) STOWED SOLAR ARRAY DYNAMIC RESPONSES APPLYING DYNAMIC ABSORBERS

J. J. Wijker 10 May 1979 64 p refs

(FOK-RV-79-43) Avail: NTIS HC A04/MF A01

To reduce the dynamic response of the European Communications Satellite stowed solar array, due to base excitations in a frequency range of 5-100 Hz, dynamic absorbers were used. The tuning frequency is 42.0 Hz. A reduction of 31 percent was achieved in the maximum dynamic amplification. Two amplification peaks at 30 and 51 Hz were observed.

Author (ESA)

N81-10470# Defence Research Establishment Pacific, Victoria (British Columbia). Research and Development Branch.

CHARPY V-NOTCH IMPACT STUDIES ON STRESS-RELIEVED HY130 WELDMENTS

B. F. Peters Dec. 1979 37 p refs

(AD-A088728; DREP-79-G) Avail: NTIS HC A03/MF A01 CSCL 11/6

A Charpy V-notch impact testing study has been conducted on samples of HY 130 steel ESR and AMVD and its weldments MIL 140 s MIG, and E12018 and E14018 stick. The parent materials and MIG weldments do not suffer from an appreciable decrease in impact strength when subjected to stress relief heat treatment followed by air cooling or furnace cooling. E14018 weldments suffer significantly when furnace cooled but not when air cooled from the stress relief heat treating temperatures. GRA

N81-10471# Illinois Univ. at the Medical Center, Chicago. Dept. of Materials Engineering.

FRACTURE BEHAVIOR OF FIBER REINFORCED CONCRETE USING THE DOUBLE CANTILEVER BEAM TECHNIQUE

Progress Report

Kitisak Visalvanich and Antoine E. Naaman May 1980 190 p refs

(Grant NSF ENG-77-23534)

(PB80-198815) Avail: NTIS HC A09/MF A01 CSCL 13C

Several reinforcing parameters are explored and include fiber length, aspect ratio, volume fraction of fibers, initial notch depth and matrix composition. Experimental results are used to evaluate the fracture properties of fiber reinforced concrete by linear elastic or elastic plastic fracture analysis techniques. Some of the more significant findings are (1) the stress intensity factor of plain mortar increases with crack extension and seems to stabilize at a crack extension of about 8 inches, no crack stabilization is observed for their reinforced mortar; (2) an initial crack opening angle is identified for plain mortar, it defines an angle at which the crack starts propagation regardless of its length; (3) large pseudoplastic zones develop at the crack front of fiber reinforced specimens and depend on the reinforcing parameters. GRA

42 GEOSCIENCES (GENERAL)

N81-10472*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR GEOLOGY: AN ASSESSMENT REPORT OF THE RADAR GEOLOGY WORKSHOP
1 Sep. 1980 515 p refs Workshop held in Snowmass, Colo., 16-20 Jul. 1979 Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-163638; JPL-Pub-80-61) Avail: NTIS HC A22/MF A01 CSCL 08G

The application of imaging radar to geologic problems is assessed. The general topics for consideration were: technique development; engineering environmental; mapping; and exploration. For individual titles, see N81-10473 through N81-10496.

N81-10473*# Arkansas Univ., Fayetteville. Dept. of Geology.
HISTORICAL SKETCH: RADAR GEOLOGY **c46**
H. MacDonald *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 23-38 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

A chronological assessment is given of the broad spectra of technology associated with radar geology. Particular attention is given to the most recent developments made in the areas of microwave Earth resources applications and geologic remote sensing from aircraft and satellite. The significance of space derived radar in geologic investigations is discussed and the scientific basis for exploiting the sensitivity of radar signals to various aspects of geologic terrain is given. R.C.T.

N81-10474*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR GEOLOGY: TECHNOLOGY AND PROGRAM OVERVIEW **c46**
Frank T. Barath *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 38-41 (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

The state-of-the-art of active microwave remote sensors (altimeters, scatterometers and imagers) used in geologic applications is assessed and the ongoing radar geology activities within NASA, government agencies, industry, universities and foreign organizations is summarized. Plans for radar geology research and development and space flight missions are also outlined. R.C.T.

N81-10475*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SIMULATION OF ORBITAL RADAR IMAGES **c32**
R. S. Saunders, J. C. Holtzman (Kansas Univ., Lawrence), and Charles Elachi *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 45-63 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 17I

The operating parameters for spaceborne synthetic aperture imaging radar systems was addressed in the cost effective manner by using simulation techniques. The use of airborne images, Seasat images, and computer simulation were the first computer simulation of spaceborne radar imagery was analyzed for system definition studies. Analysis of the simulation indicates that incidence angles as small as 30 are useful for general terrain geomorphologic analysis. R.C.T.

N81-10476*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EXPRESSION OF SAN ANDREAS FAULT ON SEASAT RADAR IMAGE **c46**
Floyd F. Sabins, Jr. (Chevron Oil Field Research Co.), R. Blom, and Charles Elachi *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 64-74 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

A Seasat image (23.5 cm wavelength) of the Durmid Hills in southern California, the San Andreas Fault was analyzed. It is shown that a prominent southeast trending tonal lineament exists that is bright on the southwest side and dark on the northeast side. The cause of the contrasting signatures on opposite sides of the lineament was determined and the geologic signficance of the lineament was evaluated. R.C.T.

N81-10477*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANALYSIS OF SEASAT ORBITAL RADAR IMAGERY FOR GEOLOGIC MAPPING IN THE APPALACHIAN VALLEY AND RIDGE PROVINCE, TENNESSEE-KENTUCKY-VIRGINIA **c43**
J. P. Ford *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 75-113 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

The terrain-surface features of the Appalachian Valley and Ridge province were analyzed using Seasat synthetic aperture radar imagery. Particular attention was given to determining the efficiency and capability of this microwave imaging system for geologic mapping. R.C.T.

N81-10478*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR IMAGING OF VOLCANIC FIELDS AND SAND DUNE FIELDS: IMPLICATIONS FOR VOIR **c43**
Charles Elachi, R. Blom, M. Daily, T. Farr, and R. S. Saunders *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 114-150 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

A number of volcanic fields and sand dune fields in the western part of North America were studied using aircraft and Seasat synthetic aperture radar images and LANDSAT images. The capability of radars with different characteristics (i.e., frequency, polarization and look angles was assessed to identify and map different volcanic features, lava flows and sand dune types. It was concluded that: (1) volcanic features which have a relatively large topographic expression (i.e., cinder cones, collapse craters, calderas, etc.) are easily identified; (2) lava flows of different ages can be identified, particularly on the L-band images; and (3) sand dunes are clearly observed and their extent and large scale geometric characteristics determined, provided the proper imaging geometry exists. R.C.T.

N81-10479*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ROCK TYPE DISCRIMINATION AND STRUCTURAL ANALYSIS WITH LANDSAT AND SEASAT DATA: SAN RAFAEL SWELL, UTAH **c43**
H. E. Stewart, R. Blom, M. Abrams, and M. Daily *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 151-167 refs Original contains color illustrations (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

Satellite synthetic aperture radar (SAR) images is evaluated in terms of its geologic applications. The benchmark to which the SAR images are compared is LANDSAT, used both for structural and lithologic interpretations. R.C.T.

N81-10480*# Geological Survey, Flagstaff, Ariz.
TERRAIN-ANALYSIS PROCEDURES FOR MODELING RADAR BACKSCATTER **c43**
Gerald G. Schaber, Graydon L. Berlin, and Richard J. Pike (Geological Survey, Menlo Park, Calif.) *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 168-199 refs (For primary document see N81-10472 01-42) (NASA Order W-12388; NASA Order W-13276; NASA Order W-13130; NASA Order W-13709)
Avail: NTIS HC A22/MF A01 CSCL 08B

Procedures developed to obtain both raw measured and surface roughness statistics for radar backscatter modeling are described. A comprehensive and highly flexible software package for terrain analysis is introduced. R.C.T.

N81-10481*# Texas A&M Univ., College Station. Remote Sensing Center.
REALISTIC EARTH/LAND RADAR MODELS **c43**

Andrew J. Blanchard *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 200-222 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

A series of models which attempt to describe more accurately the physical geometry of Earth/land targets is presented. Theoretical calculations are included to illustrate model behavior. Variations with respect to various systems and target parameters are included. R.C.T.

N81-10482*# Texas A&M Univ., College Station. Remote Sensing Center.
SOME CONFUSION FACTORS IN RADAR IMAGE INTERPRETATION c46
Bruce J. Blanchard *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 223-232 (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

Geologic interpretation of radar imagery for land use applications is discussed with reference to its dependence on classification of the radar return into categories related to some training area within the image. It is shown that such interpretation relies on the assumption that surface characteristics of areas with similar returns are truly similar. It is further shown that this may not always be true over water surfaces due to the influence of system parameters on the radar return. In imagery over land, both system parameters and scene parameters may lead to ambiguous returns which can ultimately lead to misinterpretation. R.C.T.

N81-10483# Michigan Univ., Ann Arbor.
MULTICHANNEL SAR IN GEOLOGIC INTERPRETATION: AN APPRAISAL c46
Philip L. Jackson *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 233-250 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

The use of multichannel synthetic aperture radar in geologic applications is discussed. Isolated illustrations are presented which indicate wide diversity of multichannel returns, which appear to be highly diagnostic of vegetation and lithology. R.C.T.

N81-10484*# Geological Survey, Flagstaff, Ariz.
AUTOMATIC SHADING CORRECTION AND SPECKLE NOISE MAPPING/REMOVAL TECHNIQUES FOR RADAR IMAGE DATA c32
Pat S. Chavez, Jr. *In* JPL Radar Geol.: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 251-262 refs (For primary document see N81-10472 01-42)
(NASA Order W-13130)
Avail: NTIS HC A22/MF A01 CSCL 17I

Techniques were developed to correct for shading problems, and to suppress speckle noise contained in the radar images. R.C.T.

N81-10485*# Alaska Univ., Fairbanks. Geology/Geophysics Program.
APPLICATIONS OF RADAR IMAGERY TO ARCTIC AND SUBARCTIC PROBLEMS c46
P. Jan Cannon *In* JPL Radar Geol.: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 265-274 ref (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

Radar imagery provides year around data acquisition of areas in the Arctic and the Subarctic. The foremost factor influencing the choice of radar imagery as the major data source was the demand for neotric data. The weather is so adverse in parts of Alaska that radar imagery was the only remote sensing technique which could meet the demand. The major map products derived from radar imagery are landform maps and lineament maps. These maps are used to make environmental assessments of areas and to reconstruct the geomorphic history of certain regions or features. Since radar imagery provides information about geologic structure and geomorphic features, it can be used to determine the relationship which exists between geologic structure and geomorphology. Important geologic information related to surface roughness can be obtained through a dry snow cover. Radar imagery is the only remote sensing technique which can provide information needed about sea ice through a cloud cover and dry snow, during strong wind conditions, and throughout the Arctic night. E.D.K.

N81-10486*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR DETECTION OF SURFACE OIL ACCUMULATIONS c45
John E. Estes, Peggy ONeill (California Univ., Santa Barbara), and Michael Wilson (California Univ., Santa Barbara) *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 275-292 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 13B

The United States Coast Guard is developing AIREYE, an all weather, day/night airborne surveillance system, for installation aboard future medium range surveillance aircraft. As part of this program, a series of controlled tests were conducted off southern California to evaluate the oil slick detection capabilities of two Motorola developed, side looking radars. The systems, a real aperture AN/APS-94D and a synthetic aperture coherent on receive (COR) were flown over the Santa Barbara Channel on May 19, 1976. Targets imaged during the coincident overflights included natural oil seepage, simulated oil spills, oil production platforms, piers, mooring buoys, commercial boats and barges at other targets. Based on an analysis of imagery from the coincident radar runs, COR provides better detection of natural and man made oil slicks, whereas the AN/APS-94D consistently exhibited higher surface target detection results. This and other tests have shown that active microwave systems have considerable potential for aiding in the detection and analysis of surface oil accumulations. E.D.K.

N81-10487*# Ebasco Services, Inc., Greensboro, N.C.
APPLICATIONS OF SLAR IN NUCLEAR POWER PLANT SITING: A CASE HISTORY c73
Barry S. Siegal *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 293-303 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 18E

Over 10,000 square km of side-looking airborne radar (SLAR) imagery was obtained and analyzed for the siting of the first nuclear power plant in the Republic of the Philippines. The imagery was obtained using the Motorola APS/AN-94D (X-band) real aperture system as part of an overall remote sensing program to site and evaluate potential site regions. Analysis of SLAR images, in conjunction with LANDSAT, color, black and white, and thermal infrared images, provided basic information on structure, relative geochronology, stratigraphy, geomorphology, and ground water, which facilitated field operations and data synthesis. Author

N81-10488*# Technische Hochschule, Graz (Austria). Inst. for National Surveying and Photogrammetry.
APPLICATION OF IMAGING RADAR TO MAPPING c43
Franz W. Leberl *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 307-335 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

The present state of radar mapping is reviewed. Emphasis is on radargrammetric mapping with single images, stereo pairs, and block adjustment. Applications to thematic mapping are also addressed. Examples presented concern radar mosaicking, sea ice study and extraterrestrial mapping. E.D.K.

N81-10489*# Goodyear Aerospace Corp., Litchfield Park, Ariz.
STEREO RADAR FOR MAPPING AND INTERPRETATION c43
L. Graham *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 336-350 ref (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

The use of terrain imaging radar to extract elevation information by stereo viewing and measurement is discussed. Either a three dimensional visual model or elevation measurements may be obtained by simultaneous viewing or differential measurement of images obtained by a side-looking radar from two different flightpaths. Expressions describing radar image

geometry, model vertical exaggeration, and stereo measurement accuracy are derived. The dependence of the exaggeration and accuracy on system parameters and key system errors is derived, discussed, and illustrated by application to several airborne and spaceborne systems and system concepts, and the results of some preliminary measurements of imagery from two airborne and one spaceborne system are given. E.D.K.

N81-10490*# Kansas Univ., Lawrence. Remote Sensing Lab.

A NEW LOOK AT TOGO THROUGH THE EYES OF A SLAR **c43**

Louis F. Dellwig *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 351-364 refs Sponsored in part by Mobil Foundation, Inc. (For primary document see N81-10472 01-42)

Avail: NTIS HC A22/MF A01 CSCL 08B

Imaging of Togo in 1977 with SLAR provided the data required for the production of map controlled radar mosaics at a scale of 1:200,000 with 95 percent of all control points at that scale within + or - 4.0 millimeters of true positions. The moasics served as the base for the generation of a revised geologic map of Togo. Aided by two looks, numerous revisions resulted, not only with the addition of previously unknown structural features, a revision of age relationships, and the refinement of unit boundaries, but also with the repositioning of rock units and the reorientation of major faults. E.D.K.

N81-10491*# GeoSpectra Corp., Ann Arbor, Mich.

THE USE OF RADAR AND LANDSAT DATA FOR MINERAL AND PETROLEUM EXPLORATION IN THE LOS ANDES REGION, VENEZUELA **c43**

Robert K. Vincent *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 367-384 refs (For primary document see N81-10472 01-42)

Avail: NTIS HC A22/MF A01 CSCL 08G

A geological study of a 27,500 sq km area in the Los Andes region of northwestern Venezuela was performed which employed both X-band radar mosaics and computer processed Landsat images. The 3.12 cm wavelength radar data were collected with horizontal-horizontal polarization and 10 meter spatial resolution by an Aeroservices SAR system at an altitude of 12,000 meters. The radar images increased the number of observable suspected fractures by 27 percent over what could be mapped by LANDSAT alone, owing mostly to the cloud cover penetration capabilities of radar. The approximate eight fold greater spatial resolution of the radar images made possible the identification of shorter, narrower fractures than could be detected with LANDSAT data alone, resulting in the discovery of a low relief anticline that could not be observed in LANDSAT data. Exploration targets for petroleum, copper, and uranium were identified for further geophysical work. Author

N81-10492*# Conoco, Inc., Ponca City, Okla. Exploration Research Div.

GEOLOGICAL MAPPING IN THE AMAZON JUNGLE: A CHALLENGE TO SIDE-LOOKING RADAR **c46**

Aderbal C. Correa *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 385-416 refs (For primary document see N81-10472 01-42)

Avail: NTIS HC A22/MF A01 CSCL 08G

A brief outline of the physical environment and vegetation characteristics peculiar to the Amazon Jungle is given to provide the background for the discussion of energy target interaction models. Examples of radar images of the central part of the jungle are used to illustrate a common approach to geologic mapping in this environment. During the initial phase of interpretation, the interaction phenomenon is evaluated and textural and tonal characteristics of the radar image are observed. Field checking of selected areas is the next phase of a geologic mapping program. Reinterpretation of radar images and auxiliary data (aerial photographs, Landsat images, and field data) is the last phase of geologic mapping. E.D.K.

N81-10493*# Bureau de Recherches Geologiques et Minieres, Orleans (France). Office of Geologic and Mining Research.

SIDE-LOOKING AIRBORNE RADAR IMAGE INTERPRETATION AND GEOLOGICAL MAPPING: PROBLEMS AND RESULTS **c43**

Jean-Yves Scanvic and E. H. Soubari *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 417-438 refs (For primary document see N81-10472 01-42)

Avail: NTIS HC A22/MF A01 CSCL 08B

Geological experiments and surveys conducted by BRGM and GDTA members to evaluate interest in SLAR image interpretation are summarized. Two surveys were selected for presentation: Les Vans (Massif central, France) and Guyana (South America). They have permitted a comparison between different types of SLAR: Goodyear, Motorola, JPL, and Vigie in term of lithological and structural applications. On the Les Vans test site conclusions reached concern radiometry, which is better on L-band imagery, polarization, HV being more useful than HH for geological mapping in an L-band system, wavelength and illuminations. Over Guyana, the use of Goodyear X-band SLAR enables satisfactory geological and structural mapping under heavy equatorial forest with cloud cover conditions. A differential program was developed for fracture filtering and image enhancement with a coherent light laser, and significant results were obtained. E.D.K.

N81-10494*# Woodward-Clyde Consultants, Orange, Calif.

THE EVALUATION OF 3cm-WAVELENGTH RADAR FOR MAPPING SURFACE DEPOSITS IN THE BRISTOL LAKE/GRANITE MOUNTAIN AREA, MOJAVE DESERT, CALIFORNIA **c43**

Ray Sugiura and Floyd F. Sabins, Jr. (Chevron Oil Field Research Co.) *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 439-456 refs (For primary document see N81-10472 01-42)

Avail: NTIS HC A22/MF A01 CSCL 08B

Surface deposits in the Bristol Lake/Granite Mountains area, Mojave Desert, California were mapped using high resolution 3 cm wavelength radar images. The surface deposits range from silt to boulders in size and were separated into six radar-rock units on the basis of radar return signatures (brightness and texture) and geomorphic expression. Field reconnaissance of the six units showed that the brightness of the radar signatures on the images correlates with the surface roughness of each unit. Two major radar signatures anomalies were noted during the study. A dark radar signature for the large sand ridges in the Kelso Dunes area and a distinct northwest trending contrast boundary between bright and dark radar signatures in the Bristol Dry Lake area. Field reconnaissance of the two areas indicated that near surface moisture may be the cause of dark signatures. Dune areas with little to no vegetation produce a dark signature, whereas areas with sparse to moderate vegetation produce an intermediate to dark signature. E.D.K.

N81-10495*# Phillips Petroleum Co., Bartlesville, Okla.

RADAR, AN OPTIMUM REMOTE-SENSING TOOL FOR DETAILED PLATE TECTONIC ANALYSIS AND ITS APPLICATION TO HYDROCARBON EXPLORATION (AN EXAMPLE IN IRIAN JAYA INDONESIA) **c46**

Claude M. Froidevaux *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol: Workshop 1 Sep. 1980 p 457-501 refs Original contains color illustrations (For primary document see N81-10472 01-42)

Avail: NTIS HC A22/MF A01 CSCL 08G

Geometric, geomorphic, and structural information derived from the examination of radar imagery and combined with geologic and geophysical evidences strongly indicates that Salawati Island was attached to the Irian Jaya mainland during the time of Miocene lower Pliocene reef development, and that it was separated in middle Pliocene to Pleistocene time, opening the Sele Strait rift zone. The island moved 17.5 km southwestward after an initial counterclockwise rotation of 13 deg. The rift zone is subsequent to the creation of the large left lateral Sorong fault zone that is part of the transitional area separating the westward-moving Pacific plate from the relatively stable Australian plate. The motion was triggered during a widespread magmatic intrusion of the Sorong fault zone, when the basalt infiltrated a right lateral fault system in the area of the present Sele Strait. E.D.K.

N81-10496*# Hunting Geology and Geophysics Ltd., Elstree (England).

FRACTURE TRACE EXPRESSION AND ANALYSIS IN RADAR IMAGERY OF RAIN FOREST TERRAIN (PERU) c43

Peter H. A. Martin-Kaye, J. W. Norman (Imperial Coll. of Science and Technology), and M. J. Skidmore (National Coal Board, London) *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 502-507 refs (For primary document see N81-10472 01-42)

Avail: NTIS HC A22/MF A01 CSCL 02F

Mapping of minor lineaments from radar imagery of the rain forest in southeast Peru is biased due to the selective suppression of some topography which results from the observation geometry of the imaging radar system and the varied perception of lineaments on the imagery by different interpreters. Team analysis of the imagery compensates for several of the sources of bias, and results in the clear recognition of differing regimes within the regional fracture field in the study area.

Author

N81-10497# Joint Publications Research Service, Arlington, Va.

WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY, NO. 14

5 Feb. 1980 60 p refs Transl. into ENGLISH from various European articles

(JPRS-75070) Avail: NTIS HC A04/MF A01

The need for standards and other regulations to assure product quality, to prevent ecological imbalance from genetic manipulation, and to promote the development and use of passive solar heating systems is discussed. Progress is reportd in the construction of the world's first solar electric power plant and in the design of a plant using metal hydrides for energy storage. For individual titles, see N81-10498 through N81-10502.

N81-10498# Joint Publications Research Service, Arlington, Va.

MINISTER OFFICIALS DISCUSS METROLOGY POLICY c31

In its West Europe Rept.: Sci. and Technol., No. 14 (JPRS-75070) 5 Feb. 1980 p 3-7 Transl. into ENGLISH from AFP Sci. (France), 20 Dec. 1979 p 2-6 (For primary document see N81-10497 01-42)

Avail: NTIS HC A04/MF A01

Accomplishments of the French National Bureau of Metrology during its first 10 years of operation are summarized and methods for implementing the Scrivener Law (1978) on consumer information and protection are described. These include using a clearly worded label indicating quality warranty and assurance that inspection control is genuine. Studies on the status of metrology in France confirm the extent of the demand for standardization by industry and recognition of its decisive influence on the quality of production. Industries must have internal self inspection, thus the standards themselves must by connected to secondary standards.

A.R.H.

N81-10499# Joint Publications Research Service, Arlington, Va.

FUTURE, IMPACT OF BIOMEDICAL RESEARCH EXAMINED c52

In its West Europe Rept.: Sci. and Technol., No. 14 (JPRS-75070) 5 Feb. 1980 p 11-19 Transl. into ENGLISH from Le Monde (France), 10 Nov. 1979 9 p (For primary document see N81-10497 01-42)

Avail: NTIS HC A04/MF A01

Advances in modern biology during the past 25 years are reviewed with particular emphasis on the systematic study of mutant microorganisms. Risks associated with genetic manipulation are discussed as well as possible advantages in agriculture, clinical medicine, pharmacology, industry, and waste utilization.

A.R.H.

N81-10500# Joint Publications Research Service, Arlington, Va.

WORLD'S FIRST SOLAR POWER STATION IN CATANIA c44

Taddeo Canca *In its* West Europe Rept.: Sci. and Technol., No. 14 (JPRS-75070) 5 Feb. 1980 p 20-22 Transl. into ENGLISH from Unita (Milan), 3 Dec. 1979 p 7 (For primary document see N81-10497 01-42)

Avail: NTIS HC A04/MF A01

By the end of 1980, the world's first solar electric power station the first thousand kilowatts of electric power provided by the Sun into the Italian National Electric Power Agency network. Installation of the 182 solar mirrors and costs of the power to be provided are discussed.

A.R.H.

N81-10501# Joint Publications Research Service, Arlington, Va.

OBSTACLES TO DEVELOPMENT OF PASSIVE SOLAR SYSTEMS c44

Aldo Fanchiotti *In its* West Europe Rept.: Sci. and Technol., No. 14 (JPRS-75070) 5 Feb. 1980 p 23-34 refs Transl. into ENGLISH from Fonti de Energia Alternative (Rome), Jul. - Aug. 1979 p 54-59 (For primary document see N81-10497 01-42)

Avail: NTIS HC A04/MF A01

Factors responsibile for the delay of implementation of passive systems for heating buildings in Italy may be grouped into four categories: (1) technical obstactles, such as the lack of products on the market, the lack of design tools, the lack of experimental data, and the lack of climate data; (2) economic obstacles, such as initial cost, resistance by existing interests, uncertainty about criterion of evaluation, and the price structure of energy sources; (3) obstacles to startup such as insufficient awareness, lack of experienced designers, and inertia of the construction sector; and (4) institutional obstacles related to legislation and standardization. Actions to be taken for product development and demonstration require intervention by protagonists in both government and industry.

A.R.H.

N81-10502# Joint Publications Research Service, Arlington, Va.

USE OF HYDROGEN TO STORE, TRANSMIT POWER c44

Paolo Boccanera, Andrea Moriconi, and Antonio Naviglio *In its* West Europe Rept.: Sci. and Technol., No. 14 (JPRS-75070) 5 Feb. 1980 p 35-51 refs Transl. into ENGLISH from Fonti di Energia Alternative (Rome), no. 2, Mar. - Apr. 1979 p 14-21 (For primary document see N81-10497 01-42)

Avail: NTIS HC A04/MF A01

A mode of using hydrogen specifically as an energy storage component is discussed. A system is described in which electrical energy taken from the power distribution network during low-demand periods is used to produce H2 by electrolysis. The hydrogen energy potential produced is stored by absorption of the gas in iron-titanium hydrid beds, from which it is recovered (during energy peak demand periods) in the form of electrical energy through hydrogen-fueled fuel cells, that is, electric cells that use as a fuel the hydrogen previously absorbed by the FeTi hydride and subsequently dissociated from it through simple heating. The thermal energy developed during the formation of the metallic hydride and that which must be supplied to release hydrogen are respectively removed and transferred by a thermal-carrier liquid circulating in pipes inside the vessels containing the hydride.

A.R.H.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see *35 Instrumentation and Photography*.

N81-10503 Kansas Univ., Lawrence.

MICROWAVE REMOTE SENSING OF SNOWPACKS Ph.D. Thesis

William Herschel Stiles 1980 436 p

Avail: Univ. Microfilms Order No. 8026727

The interaction mechanisms responsible for the microwave backscattering and emission behavior of snow were investigated, and models were developed relating the backscattering coefficient and apparent temperature to the physical parameters of the snowpack. The microwave responses to snow wetness, snow water equivalent, snow surface roughness, and to diurnal variations were investigated. Snow wetness was shown to have an increasing

effect with increasing frequency and angle of incidence for both active and passive cases. Increasing snow wetness was observed to decrease the magnitude of backscattering coefficient and increase apparent temperature. Snow water equivalent was also observed to exhibit a significant influence on both backscattering coefficient and apparent temperature. Snow surface configuration (roughness) was observed to be significant only for wet snow surface conditions. Diurnal variations were as large as 15 dB for backscattering coefficient at 35 GHz and 120 K apparent temperature at 37 GHz. Simple models of a snowpack scene were developed in terms of the most significant ground truth parameters. The coefficients for these models were then evaluated; the fits to the measurements obtained were generally good.

Dissert. Abstr.

N81-10504# Defense Mapping Agency Hydrographic and *Topographic Center, Washington, D.C.*

DMA'S ROLE WITH THE MARINER

Dennis J. Granato Sep. 1980 25 p Presented at Intern. *Symp. on Ship Operations*

(AD-A089297) Avail: NTIS HC A02/MF A01 CSCL 08/2

This paper addresses the organization, mission, and service that the Defense Mapping Agency (DMA), specifically, the Hydrographic/Topographic Center (HTC), provides to the general mariner. Included in the discussion are the following: the interface between DMA and the merchant mariner, how the requirements process works to support merchant marine activities, and how the merchant marine can aid DMA's product availability and accuracy through a data collection effort. GRA

N81-10505# *California Univ., Riverside. Dept. of Soil and* Environmental Sciences.

ARID LAND PLANTS: PROMISING NEW TOOLS FOR ECONOMIC DEVELOPMENT AND BASIC RESEARCH

Peter Felker 1980 23 p refs Presented at the Symp. on the *Econ. Develop. of Desert Plants, Univ. of Arizona, Tucson, 4 Aug.* 1980

(Contract DE-FG01-78ET-20023)

(CONF-800840-1) Avail: NTIS HC A02/MF A01

An overview is presented of arid land plant development stressing products and plant physiological and ecological concepts *unique to arid land plants. Integration of arid land crops into* polyculture management systems is suggested utilizing specialized plant functions, e.g., drought resistance, resistance to salinity, *ability to fix nitrogen, frost tolerance, and capability to produce* a cash crop. Impacts of arid land plant productivity on political systems of developing countries are discussed and recommendations are presented for overcoming institutional constraints facing arid land plant development. DOE

N81-10506# California Univ., Livermore. Lawrence Livermore Lab.

RESERVOIR RESPONSE TO TIDAL AND BAROMETRIC EFFECTS

Jonathan M. Hanson 29 May 1980 5 p refs Presented at *Geothermal Resources Council 1980 Ann. Meeting, Salt Lake* City, 9-11 Sep. 1980 Submitted for publicaton

(Contract W-7405-eng-48)

(UCRL-84461; CONF-800920-13) Avail: NTIS HC A02/MF A01

Solid earth tidal strain and surface loading due to fluctuations in barometric pressure have the effect, although extremely minute, of dilating or contracting the effective pore volume in a porous reservoir. If a well intersects the formation, the change in pore pressure can be measured with sensitive pressure gauges. Mathematical models of the relevant fluid dynamics of the *well-reservoir system were generated and tested against* conventional well pumping results or core data at the Salton Sea Geothermal Field, California and at the Raft River, Geothermal Field, Idaho. Porosity-total compressibility product evaluation based on tidal strain response compares favorably with results *based on conventional pumping techniques. Analysis of reservoir* response to barometric loading using Auto Regressive Integrated Moving Average stochastic modeling appears also to have *potential use for the evaluation of reservoir parameters.* DOE

N81-10507# *Societe Nationale Industrielle Aerospatiale, Cannes* (France).

USE OF COLOR TECHNIQUES FOR IMAGE AND EXPERIMENTAL DATA PROCESSING [ETUDES DES TECHNIQUES DE COULEUR POUR LE TRAITEMENT DES DONNEES IMAGES ET EXPERIMENTALES]

Michel Albuisson (Ecole Nationale Superieure des Mines, Sophia-Antipolis, France), Roselyne Dupre, Guy Lebegue, and Jean-Marie Monget (Ecole Nationale Superieure des Mines, Sophia-Antipolis, France) Oct. 1979 253 p refs In FRENCH Original contains color illustrations

(Contract ESOC-3583/79)

(ESA-CR(P)-1294) Avail: NTIS HC A12/MF A01

Methods, algorithms and instruments allowing the use of color techniques for the processing of information incoming from satellites are described. Various methods of optical data processing are surveyed and applied to LANDSAT satellite images, METEOSAT satellite telemetry measurement, and GEOS satellite experimental data. Color treatment material presently available on the market is examined. The main characteristics of a simplified system for color data processing are outlined.

Author (ESA)

N81-10508# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

A STUDY ON THE DETERMINATION OF THE KOOTWIJK-WETTZELL BASELINE FROM SATELLITE LASER RANGING AT THESE STATIONS

K. F. Wakker and B. A. C. Ambrosius Jan. 1980 28 p refs *Presented at 2nd Meeting of the Lageos Working Group,* Greenbelt, Md., Feb. 1980

(VTH-LR-295) Avail: NTIS HC A03/MF A01

Results are presented of a preliminary study to determine the Kootwijk-Wettzell baseline and the Wettzell coordinates from satellite laser ranging. Five different estimates were obtained, based on three single arc, one two arc and one four arc solutions. The arcs were formed from 32 passes of four satellites over *only the Kootwijk and Wettzell ranging stations during the period* July 11 to August 24, 1978. Special attention was paid to the effects of the orbit station geometry, the number of passes, and *the distribution of the passes over a time span.* Author (ESA)

N81-10509# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).

PRECISE MODELING ASPECTS OF LUNAR MEASUREMENTS AND THEIR USE FOR THE IMPROVEMENT OF GEODETIC PARAMETERS

Artur Stolz 1979 23 p refs Sponsored by Alexander von *Humboldt Siftung*

(SER-A-90; ISBN-3-7696-8173-8; ISSN-0065-5309) Avail: NTIS HC A02/MF A01

A description of the modeling of the lunar laser two way time delay is presented. The formulas employed for diurnal polar motion, short period tidal variations in universal time (UT), the *effects of the Earth's nonrigidity on the nutation series, horizontal* and vertical components of Earth-tidal deformation, retardation of the photon by the atmosphere, and relativistic effects on the measurement of time and the path of the photon are given. The use of the data for improving telescope coordinates, polar *motion, and UT is described. Also discussed are the correlations* which exist between ephemeris errors and errors in UT and polar motion, and between errors in UT and the y coordinate of *the pole.* Author (ESA)

N81-10510# *Research Inst. of National Defence, Stockholm* (Sweden).

APPLICATIONS OF REMOTE SENSING TO OCEANOGRAPHY AND SEA ICE

Ragnar Thoren 1980 70 p refs Presented at 14th Congr. of *the Intern. Soc. of Photogrammetry on Oceanog. and Sea Ice,* Hamburg, 13-26 Jul. 1980

(FOA-B-60001-M7) Avail: NTIS HC A04/MF A01

The program of an interdisciplinary artic expedition for scientific studies is described. Included among the subjects to be studied are: ice conditions; ice-ocean interaction in the marginal *ice zone; radar measurements of backseatter from September* sea ice; and glacial extent and climatic variations. The problem *of navigation hazards due to icebergs and the ice surveillance* by advanced remote sensors are discussed. The possibility of

under-ice navigation is summarized with respect to remote sensor developments. Author (ESA)

N81-10511# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO HYDROLOGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980
Audrey S. Hundemann Aug. 1980 230 p Supersedes NTIS/PS-79/0845; NTIS/PS-78/0792 Updates NTIS/PS-76/0500
(PB80-813132; NTIS/PS-79/0845; NTIS/PS-76/0500) Avail: NTIS HC $30.00/MF $30.00 CSCL 08H

The use of aerial and satellite imagery in hydrologic studies, including water resources planning and management, is discussed. The abstracts cover remote sensing studies of water quality, soil moisture, floodplain delineation, ice cover, and determination of snow depth and water equivalent. This updated bibliography contains 225 citations, 15 of which are new entries to the previous edition. GRA

N81-10512# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO URBAN REGIONAL PLANNING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980
Audrey S. Hundemann Aug. 1980 74 p Supersedes NTIS/PS-79/0843; NTIS/PS-78/0790
(PB80-813116; NTIS/PS-79/0843; NTIS/PS-78/0790) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

Urban and regional planning using aerial photography and satellite remote sensing methods is discussed. Abstracts cover the use of remote sensing in land use mapping, traffic surveys and urban transportation planning, and taking inventories of natural resources for urban planning. Abstracts dealing with land use and residential quality associated with and acting as an influence on health and physical well being are included. GRA

N81-10513# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO GEOLOGY AND MINERALOGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1973 - Jul. 1980
Audrey S. Hundemann Aug. 1980 192 p Supersedes NTIS/PS-79/0844; NTIS/PS-78/0791
(PB80-813124; NTIS/PS-79/0844; NTIS/PS-78/0791) Avail: NTIS HC $30.00/MF $30.00 CSCL 08G

The use of LANDSAT satellites (formerly Earth Resources Technology Satellites (ERTS)) and other remote sensing methods in geological and mineralogical applications is discussed. Abstracts cover rock and soil mapping, terrain analysis, direct and indirect mineral exploration, fault tectonics, and general geologic studies of various countries. A few abstracts pertain to equipment and techniques used in the studies. GRA

N81-10514# Guam Univ., Agana. Water Resources Research Center.
A REVIEW OF TECHNIQUES FOR STUDYING FRESHWATER/SEAWATER RELATIONSHIPS IN COASTAL AND ISLAND GROUNDWATER FLOW SYSTEMS
Dinshaw N. Contractor May 1980 35 p refs
(Grants DI-14-34-0001-7024; DI-14-34-0001-9012)
(PB80-193857; W80-05538; TR-11; OWRT-A-007-GUAM(1)) Avail: NTIS HC A03/MF A01 CSCL 08H

The analytic and numeric methods available for the study of saltwater intrusion into freshwater aquifers in coastal and island situations are reviewed and summarized. The methods are divided into three categories. The first deals with closed-form analytic solutions of steady interface problems using the hodograph method. In these problems, the saltwater and freshwater are separated by an abrupt interface and the location of this interface is determined for simple aquifer geometries and boundary conditions. These solutions can also be used to test the accuracy of numerical techniques. The second category of methods deals with solutions using the Dupuit and Ghyben-Herzberg approximations. GRA

N81-10515# EIC, Inc., Newton, Mass.
ATMOSPHERIC LOADINGS TO WATERS OF THE FOUR UPPER GREAT LAKES Status Report
Charles T. Elly Feb. 1980 240 p
(PB80-209356; EPA-905/8-80-002) Avail: NTIS HC A11/MF A01 CSCL 08H

A summary of loadings to the lakes for 33 parameters including pH, conductance, solids, sulfates, chlorides, nitrogens, phosphorus, and 23 metals, during the period from August, 1978 to July, 1979 is presented. An assessment of problems which plague the program and recommendations to follow in order for Region V to obtain useable atmospheric loading data is also given. GRA

N81-10477*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANALYSIS OF SEASAT ORBITAL RADAR IMAGERY FOR GEOLOGIC MAPPING IN THE APPALACHIAN VALLEY AND RIDGE PROVINCE, TENNESSEE-KENTUCKY-VIRGINIA
J. P. Ford *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 75-113 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10478*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR IMAGING OF VOLCANIC FIELDS AND SAND DUNE FIELDS: IMPLICATIONS FOR VOIR
Charles Elachi, R. Blom, M. Daily, T. Farr, and R. S. Saunders *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 114-150 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10479*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ROCK TYPE DISCRIMINATION AND STRUCTURAL ANALYSIS WITH LANDSAT AND SEASAT DATA: SAN RAFAEL SWELL, UTAH
H. E. Stewart, R. Blom, M. Abrams, and M. Daily *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 151-167 refs Original contains color illustrations (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10480*# Geological Survey, Flagstaff, Ariz.
TERRAIN-ANALYSIS PROCEDURES FOR MODELING RADAR BACKSCATTER
Gerald G. Schaber, Graydon L. Berlin, and Richard J. Pike (Geological Survey, Menlo Park, Calif.) *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 168-199 refs (For primary document see N81-10472 01-42) (NASA Order W-12388; NASA Order W-13276; NASA Order W-13130; NASA Order W-13709)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10481*# Texas A&M Univ., College Station. Remote Sensing Center.
REALISTIC EARTH/LAND RADAR MODELS
Andrew J. Blanchard *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 200-222 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10488*# Technische Hochschule, Graz (Austria). Inst. for National Surveying and Photogrammetry.
APPLICATION OF IMAGING RADAR TO MAPPING
Franz W. Leberl *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 307-335 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10489*# Goodyear Aerospace Corp., Litchfield Park, Ariz.
STEREO RADAR FOR MAPPING AND INTERPRETATION
L. Graham *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 336-350 ref (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10490*# Kansas Univ., Lawrence. Remote Sensing Lab.
A NEW LOOK AT TOGO THROUGH THE EYES OF A SLAR
Louis F. Dellwig *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 351-364 refs Sponsored in part by Mobil Foundation, Inc. (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10491*# GeoSpectra Corp., Ann Arbor, Mich.
THE USE OF RADAR AND LANDSAT DATA FOR MINERAL AND PETROLEUM EXPLORATION IN THE LOS ANDES REGION, VENEZUELA
Robert K. Vincent *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 367-384 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

N81-10493*# Bureau de Recherches Geologiques et Minieres, Orleans (France). Office of Geologic and Mining Research.
SIDE-LOOKING AIRBORNE RADAR IMAGE INTERPRETATION AND GEOLOGICAL MAPPING: PROBLEMS AND RESULTS
Jean-Yves Scanvic and E. H. Soubari *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 417-438 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10494*# Woodward-Clyde Consultants, Orange, Calif.
THE EVALUATION OF 3cm-WAVELENGTH RADAR FOR MAPPING SURFACE DEPOSITS IN THE BRISTOL LAKE/GRANITE MOUNTAIN AREA, MOJAVE DESERT, CALIFORNIA
Ray Sugiura and Floyd F. Sabins, Jr. (Chevron Oil Field Research Co.) *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 439-456 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08B

N81-10496*# Hunting Geology and Geophysics Ltd., Elstree (England).
FRACTURE TRACE EXPRESSION AND ANALYSIS IN RADAR IMAGERY OF RAIN FOREST TERRAIN (PERU)
Peter H. A. Martin-Kaye, J. W. Norman (Imperial Coll. of Science and Technology), and M. J. Skidmore (National Coal Board, London) *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 502-507 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 02F

N81-10682 Joint Publications Research Service, Arlington, Va.
CHOICE OF METHOD FOR LONG-TERM STORAGE OF NUTRIENT SOLUTIONS USED TO GROW VEGETABLES
I. V. Gribovskaya, I. A. Gladchenko, O. I. Novoselova, G. S. Petrov, and L. L. Martynenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 121-125 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 79-81 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-10516 Arkansas Univ., Fayetteville.
AN INVESTIGATION OF SERVICE AND REFUELING INFRASTRUCTURE FOR ENERGY STORAGE VEHICLES Ph.D. Thesis
Jerry Don Wall 1980 120 p
Avail: Univ. Microfilms Order No. 8026082

The service infrastructure for energy storage vehicles (ESV's) is examined to determine barriers to the introduction of ESV's into the private transportation sector. Electrically rechargeable battery powered vehicles, aluminum/air fuel cell vehicles, and hydrogen powered vehicles are considered. Implications of infrastructure for hybrid vehicles are also discussed. Service delivery systems and refueling methods are identified. Refueling methods for electrically rechargeable vehicles, which are investigated, include overnight home recharging, recharging at parking facilities of businesses, employers and institutions (distributed refueling) and battern exchange systems. The potential for each method is examined and the relative cost of various alternatives is investigated. The production, distribution and supply of aluminum fuel and of hydrogen are considered. Retrofitting possibilities of existing service facilities are examined for each ESV type. Design implications for retrofitting and new facility construction are discussed. Dissert. Abstr.

N81-10517*# United Technologies Corp., South Windsor, Conn. Power Systems Div.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS) VOLUME 5: ANALYTICAL APPROACH AND RESULTS Final Report
Jan. 1980 176 p refs
(Contracts DEN3-30; EC-77-A-31-1062)
(NASA-CR-159763; DOE/NASA/0030-80/5; UTC-FCR-1333)
Avail: NTIS HC A09/MF A01 CSCL 10B

Data and information in the area of advanced energy conversion systems for industrial cogeneration applications in the 1985 to 2000 time period are provided. Six current and thirty-six advanced energy conversion systems were defined and combined with appropriate balance of plant equipment. Twenty-six industrial processes were selected from among the high energy consuming industries to serve as a framework for the study. Each conversion system was analyzed as a cogenerator with each industrial plant. Fuel consumption, costs, and environmental intrusion were evaluated and compared to corresponding traditional values. Various cogeneration strategies were analyzed and both topping and bottoming (using industrial by-product heat) applications were included. The advanced energy conversion technologies indicated reduced fuel consumption, costs, and emissions. Typically fuel energy savings of 10 to 25 percent were predicted compared to traditional on site furnaces and utility electricity. Gas turbines and combined cycles indicated high overall annual cost savings. Steam turbines and gas turbines produced high estimated returns. In some applications, diesels were most efficient. The advanced technologies used coal derived fuels, or coal with advanced fluid bed combustion or on site gasification systems. R.K.G.

N81-10518*# Security State Bank, Starkville, Miss.
SOLAR HEATING SYSTEM AT SECURITY STATE BANK, STARKVILLE, MISSISSIPPI Final Report
Aug. 1980 95 p Sponsored by NASA. Marshall Space Flight Center
(Contract EM-78-F-01-5198)
(NASA-CR-161550) Avail: NTIS HC A05/MF A01 CSCL 10B

The 312 square feet of Solaron flat plate air collectors provide for 788 square feet of space heating, an estimated 55 percent of the heating load. Solar heated air is distributed to the 96 cubic foot steel cylinder, which contains two inch diameter rocks. An air handler unit moves the air over the collector and into the steel cylinder. Four motorized dampers and two gravity dampers are also part of the system. A Solaron controller which has sensors located at the collectors, rock storage, and at the return air, automatically controls the system. Auxiliary heating energy is provided by electric resistance duct heaters. Author

N81-10519*# Days Inn of America, Inc., Atlanta, Ga.
SOLAR HOT WATER SYSTEM INSTALLED AT DAY'S

LODGE, ATLANTA, GEORGIA Final Report
Sep. 1980 23 p Sponsored by NASA. Marshall Space Flight Center
(Grant EG-77-G-01-1632)
(NASA-CR-161559) Avail: NTIS HC A02/MF A01 CSCL 10A

The solar energy hot water system installed in the Days Inns of America, Inc., Atlanta, Georgia is described. This system provides for 81 percent of the total hot water demand. There are two separate systems, each serving one building of the lodge (total of 65 suites). The entire system contains only potable city water. The 1024 square feet of Grumman Sunstream Model 332 liquid flat plate collectors and the outside piping drain whenever the collector plates approach freezing or when power is interrupted. Solar heated water from the two above ground cement lined steel tanks (1000 gallon tank) is drawn into the electric Domestic Hot Water (DHW) tanks as hot water is drawn. Electric resistance units in the DHW tanks top off the solar heated water, if needed, to reach thermostat setting. T.M.

N81-10520*# Shoney's South, Inc., Memphis, Tenn.
SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT SHONEY'S RESTAURANT, NORTH LITTLE ROCK, ARKANSAS Final Contractor Report
Aug. 1980 123 p
(Contract EM-78-F-01-5188)
(NASA-CR-161557) Avail: NTIS HC A06/MF A01 CSCL 10A

A solar heating system designed to supply a major portion of the space and water heating requirements for a restaurant is described. The restaurant has a floor space of approximately 4,650 square feet and requires approximate 1500 gallons of hot water daily. The solar energy system consists of 1,428 square feet of Chamberlain flat plate liquid collector subsystem, and a 1500 gallon storage subsystem circulating hot water producing 321 x 10 to the 6th power Btu/Yr (specified) building heating and hot water heating. R.C.T.

N81-10521*# Days Inn of America, Inc., Atlanta, Ga.
SOLAR HOT WATER SYSTEM INSTALLED AT DAY'S INN MOTEL, DALLAS, TEXAS (VALLEY VIEW) Final Contractor Report
Sep. 1980 47 p
(Contract EG-77-G-01-1632)
(NASA-CR-161570) Avail: NTIS HC A03/MF A01 CSCL 10A

The solar system was designed to provide 65 percent of the total domestic hot water (DHW) demand. A liquid (water) flat plate collector (1,000 square feet) system automatically drains into the 1,000 gallon steel storage tank when the solar pump is not running. Heat is transferred from the DHW tanks through a shell and tube heat exchanger. A circulating pump between the DHW tanks and heat exchanger enables solar heated water to help make up standby losses. All pumps are controlled by differential temperature controllers. L.F.M.

N81-10522*# Days Inn of America, Inc., Atlanta, Ga.
SOLAR HOT WATER SYSTEM INSTALLED AT DAY'S INN MOTEL, SAVANNAH, GEORGIA Final Contractor Report
Sep. 1980 44 p
(Contract EG-77-G-01-1632)
(NASA-CR-161561) Avail: NTIS HC A03/MF A01 CSCL 10A

The Solar System was designed to provide 50 percent of the total Domestic Hot Water (DHW) demand. Liquid Flat Plate Collectors (900 square feet) are used for the collector subsystem. The collector subsystem is closed loop, using 50 percent Ethylene Glycol solution antifreeze for freeze protection. The 1,000 gallon fiber glass storage tank contains two heat exchangers. One of the heat exchangers heats the storage tank with the collector solar energy. The other heat exchanger preheats the cold supply water as it passes through on the way to the Domestic Hot Water (DHW) tank heaters. Electrical energy supplements the solar energy for the DHW. The Collector Mounting System utilizes guy wires to structurally tie the collector array to the building. L.F.M.

N81-10523*# Days Inn of America, Inc., Atlanta, Ga.
SOLAR HOT WATER SYSTEM INSTALLED AT DAYS INN MOTEL, JACKSONVILLE, FLORIDA Final Contractor Report
Sep. 1980 32 p
(Contract EG-77-G-01-1632)
(NASA-CR-161560) Avail: NTIS HC A03/MF A01 CSCL 10A

The solar system was designed to provide 65 percent of the hot water demand. Water in the liquid flat plate collector (900 square feet) system automatically drains into the 1000 gallon lined and vented steel storage tank when the pump is not running. Heat is transferred from storage to Domestic Hot Water (DHW) tanks through a tube and shell heat exchanger. A circulating pump between the DHW tanks and heat exchanger enables solar heated water to help make up DHW standby losses. All pumps are controlled by differential temperature. L.F.M.

N81-10524*# Days Inn of America, Inc., Atlanta, Ga.
SOLAR HOT WATER SYSTEM INSTALLED AT DAYS INN MOTEL, DALLAS, TEXAS (FORREST LANE) Final Report
Sep. 1980 47 p Sponsored by NASA. Marshall Space Flight Center
(Grant EG-77-G-01-1632)
(NASA-CR-161569) Avail: NTIS HC A03/MF A01 CSCL 10A

The solar system was designed to provide 65 percent of the total Domestic Hot Water (DHW) demand. The liquid flat plate (water) collector (1,000 square feet) system automatically drains into the 1,000 gallon steel storage tank located in the mechanical room when the pump is not running. Heat is transferred from the storage tank to DHW tanks through a tube and shell heat exchanger. A circulating pump between the DHW tanks and the heat exchanger enables solar heated water to help make DHW tank standby losses. All pumps are controlled by differential temperature. Author

N81-10525# PTL Consulting Services, Frederick, Md.
THE HIGHWAY ENGINEER'S GUIDE TO ALTERNATIVE ENERGY SOURCES AND APPLICATIONS
Marian F. Eilers and John C. Laughland Jan. 1980 154 p refs Sponsored by Federal Highway Adminstration
(FHWA-TS-80-212) Avail: NTIS HC A08/MF A01

A summary of historical energy use patterns is presented. Alternative energy sources and their applications to highway design and construction are presented. T.M.

N81-10526*# Rice Univ., Houston, Tex.
ELECTROSTATIC PROTECTION OF THE SOLAR POWER SATELLITE AND RECTENNA. PART 2: LIGHTNING PROTECTION OF THE RECTENNA Final Report
Washington NASA Nov. 1980 124 p
(Contract NAS8-33023)
(NASA-CR-3345) Avail: NTIS HC A06/MF A01 CSCL 22B

Computer simulations and laboratory tests were used to evaluate the hazard posed by ligtning flashes to ground on the Solar Power Satellite rectenna and to make recommendations on a lightning protection system for the rectenna. The distribution of lightning over the lower 48 of the continental United States was determined, as were the interactions of lightning with the rectenna and the modes in which those interactions could damage the rectenna. Lightning protection was both required and feasible. Several systems of lightning protection were considered and evaluated. These included two systems that employed lightning rods of different lengths and placed on top of the rectenna's billboards and a third, distribution companies; it consists of short lightning rods all along the length of each billboard that are connected by a horizontal wire above the billboard. The distributed lightning protection system afforded greater protection than the other systems considered and was easier to integrate into the rectenna's structural design. T.U.

N81-10527*# Rockwell International Corp., Columbus, Ohio.
SATELLITE POWER SYSTEMS (SPS) LASER STUDIES. VOLUME 1: LASER ENVIRONMENTAL IMPACT STUDY Final Report, Oct. 1978 - Mar 1979
R. E. Beverly, III Washington Nov. 1980 87 p refs

(Contract NAS8-32475)
(NASA-CR-3346; SSD-80-0119-1) Avail: NTIS HC A05/MF A01 CSCL 10A

The environmental impact of space to Earth power transmission using space borne laser subsystems is emphasized. A laser system is defined, estimates of relevant efficiencies for laser power generation and atmospheric transmission are developed, and a comparison is made to a microwave system. Ancillary issues, such as laser beam spreading, safety and security, mass and volume estimates and technology growth are considered. R.K.G.

N81-10528# Wisconsin Univ., Madison. Dept. of Chemistry.
LUMINESCENT PROPERTIES OF SEMICONDUCTOR PHOTOELECTRODES
Arthur B. Ellis and Bradley R. Karas 12 Aug. 1980 51 p refs Submitted for publication
(Contract N00014-78-C-0633)
(AD-A089215; TR-1) Avail: NTIS HC A04/MF A01 CSCL 07/4

The use of luminescent, n-type 5-1000-ppm CdS:Te and 10 ppm-CdS:Ag polycrystalline photoelectrodes as probes of recombination in photo-electrochemical cells is reported. Except for intensity, the emission spectra (lambda sub max, 600-700 nm) are insensitive to the presence of S2-/Sn2- electrolyte and to the excitation wavelengths and electrode potentials employed. With ultraband gap irradiation (lambda less than or = 500 nm) and aqueous S2-/Sn2- or Te2-/(Te2)2- electrolytes, optical energy is converted to electricity at 0.1-5% efficiency and to luminescence at 0.01-1.0% efficiency; the effects of surface preparation and grain boundaries in determining efficiency and discussed. Increasingly negative bias applied to CdS:Te and CdS:Ag photoanodes increases emission intensity by 15-100% while the photocurrent simultaneously declines to zero. Band gap edge 514.5-nm excitation yields smaller photocurrents and larger but much less potential dependent emission intensity. These results are consistent with the band bending model presently used to described photoelectrochemical phenomena. GRA

N81-10529# Wisconsin Univ., Madison. Dept. of Chemistry.
LUMINESCENT PHOTOELECTROCHEMICAL CELLS. 2: DOPED CADMIUM SULFIDE PHOTOELECTRODES AS PROBES OF EXCITED-STATE PROCESSES WHICH INFLUENCE OPTICAL TO ELECTRICAL ENERGY CONVERSION
Bradley R. Karas and Arthur B. Ellis 12 Aug. 1980 62 p refs Submitted for publication
(Contract N00014-78-C-0633; NR Proj. 051-690)
(AD-A089216; TR-2) Avail: NTIS HC A04/MF A01 CSCL 07/4

The use of photoelectrochemical cells (PECs) to mediate the direct conversion of optical energy to electricity is receiving widespread attention. Typical PECs consist of an n-type semiconductor photoanode, a counterelectrode and the electrolyte. The key elements are the semiconductor which functions in the dual roles of photoreceptor and electrode, and the electrolyte which must possess the important features of inhibiting the photocorrosion of the semiconductor. A variety of PECs have now been constructed using these principles and the goal of researchers in the field in generally to optimize the efficiency and longevity of such devices. This report discusses a promising avenue to optimizing efficiency involves characterization of the excited state processes governing the semiconductor electrode. Deactivation of the excited electrode to produce photocurrent and, hence, electricity is only one of several decay paths available. GRA

N81-10530# ARCAED, London (England).
INVESTIGATION OF PASSIVE HEATING AND COOLING WORK IN EUROPE Final Report
R. M. Lebens, B. Arch, and H. J. Birch 1980 78 p refs
(EUR-6695-EN) Avail: NTIS HC A05/MF A01

A brief history is given of passive solar work. Definitions of passive solar design systems, available passive solar design methods, monitoring, and meteorological data for passive solar work are discussed. Passive solar research in Europe as well as passive solar buildings in Europe are included. DOE

N81-10531# Wisconsin Univ., Madison. Dept. of Chemistry.
THERMAL MANIPULATION OF DEACTIVATION PROCESSES IN LUMINESCENT PHOTOELECTROCHEMICAL CELLS EMPLOYING TELLURIUM-DOPED CADMIUM SULFIDE PHOTOELECTRODES
Bradley R. Karas, David J. Morano, Daniel K. Bilich, and Arthur B. Ellis 12 Aug. 1980 35 p refs Submitted for publication
(Contract N00014-78-C-0633)
(AD-A089217; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/4

Temperature significantly modifies the efficiencies of luminescence and photocurrent in an n-type, single crystal, CdS:Te-based photoelectrochemical cell (PEC) employing aqueous polyselenide electrolyte. Between 20 and 100 C photocurrent (quantum yield phi sub x) from ultraband gap 501.7 nm excitation increases modestly by less than + or - 20%, whereas photocurrent from bandgap edge 514.5 nm excitation increases by about an order of magnitude, reaching 50-100% of the 20 C 501.7 nm photocurrent. Undoped CdS exhibits a similar photocurrent-temperature profile. Higher temperatures thus extend the wavelength response of CdS- and CdS:Te-based PEC's. In contrast to the increase in photocurrent, emissive efficiency (quantum yield phi sub r) of CdS:Te drops by a factor of approximately 10-20 over the same temperature range; this decline is relatively insensitive to potential and excitation wavelength (501.7 or 514). GRA

N81-10532# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
RELIABILITY ENGINEERING IN SOLAR ENERGY. WORKSHOP PROCEEDINGS
Gordon Gross Mar. 1980 46 p refs Workshop held in Denver, 30-31 May 1979
(Contract DE-AC02-77CH-00178)
(SERI/TP-334-489) Avail: NTIS HC A03/MF A01

A workshop to reveal the scope of reliability related activities in solar energy conversion projects and in nonsolar segments of industry is described. Two reliability programs, one in heating and cooling and one in photovoltaics, are explicated. General suggestions are presented for the establishment of a unified program for reliability, durability, maintainability, and safety in present and future solar projects. DOE

N81-10533# Atlas Corp., Santa Cruz, Calif.
MONITORING THE PERFORMANCE OF SOLAR HEATED AND COOLED BUILDINGS. VOLUME 2: MEASURING INSTRUMENTS: SELECTION, CALIBRATION, AND INSTALLATION Final Report
P. R. Armstrong, T. L. Freeman, F. deWinter, and H. Grunes Nov. 1979 221 p refs Sponsored by Electrical Power Research Inst. 2 Vol.
(EPRI-ER-1239-Vol-2) Avail: NTIS HC A10/MF A01

Measurements needed to assess the thermal performance of solar heated or cooled buildings are discussed. Transducers most appropriate for monitoring are discussed in detail. These include, for temperature: semiconductor sensors, thermistors, and thermopiles; for flow: positive displacement and propeller meters with pulse train outputs and heated sensor probes; and for insolation: thermopile and photovoltaic pyranometers. The measurements of concern in passive buildings: heat flux, temperature time trajectories and mean radiant temperature; and the measurements generally needed to compute thermal capacitance rates in air systems: pressure and humidity; are also discussed. Calibration, installation, and signal interfacing considerations are reviewed. Special techniques for measuring fluid flows and enthalpy rates associated with fluid flows (using Btu meters) are described and some new designs proposed. Also presented are a transducer selection procedure, an analysis of sampling error and error propagation, and a review of grounding and shielding practice. DOE

N81-10534# ESB Technology Co., Yardley, Pa.
DEVELOPMENT OF THE SODIUM-ANTIMONY TRICHLORIDE BATTERY FOR UTILITY APPLICATION Final Report
Feb. 1980 167 p
(EPRI Proj. 109-3)
(EPRI-EM-1323) Avail: NTIS HC A08/MF A01

An overview is presented of the development of a moderate

temperature molten salt Na alumina/SbC3 battery for load leveling and peaking applications. Cell tests are described on 2 Wh disc cells and 20, 50, and 80 Wh tube cells. Their charge discharge characteristics were used to project the design and performance of 200 Wh single tube subcells and 625 kWh modules for a 20 MW, 100 MWh load leveling battery. An updated price analysis predicted a price of $74/kWh for truck transportable 625 kWh modules, including weatherproof insulating housing, cooling system, voltage and temperature monitoring accessories. Basic electrochemical investigations are presented as the basis of an understanding of the corrosion of molybdenum and nickel current collectors in the positive mix. Tungsten coated nickel collectors are the preferred long life design. Polymeric sodium seals did not survive in larger cells. DOE

N81-10535# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
DEVELOPMENT OF POLYCRYSTAL GaAs SOLAR CELLS Quarterly Technical Progress Report, 15 Jan. - 30 Apr. 1979
D. L. Miller, Marshall J. Cohen, J. S. Harris, Jr., Joseph Ballantyne (Cornell Univ., N.Y.), Alfred Hoyte (Howard Univ.), and Elias Stefanakos (North Carolina A and T State Univ.) May 1979 46 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T3; QTPR-1) Avail: NTIS HC A03/MF A01

Progress is reported on a study of junction formation in large grain polycrystal GaAs. Characterization of the electronic properties of polycrystal GaAs grown by MBE on low cost foreign substrates; optimizing the structure of AlGaAs-GaAs heterojunction Schottky barrier solar cells; and a variety of grain boundary measurements are presented including Scanning Light Microscopy, Deep Level Transient Spectroscopy, SIMS and temperature dependent resistivity. DOE

N81-10536# Solar Environmental Engineering Co., Inc., Fort Collins, Colo.
SOLAR INDEX PREDICTION METHODOLOGY FOR EARLY DELIVERY
Loren J. Lantz 1980 13 p
(Contract DE-AC02-77ET-20090)
(DOE/ET-20090/7) Avail: NTIS HC A02/MF A01

Since the beginning of the Solar Index project in 1978, one of the primary objectives was to deliver the Indices in midafternoon local standard time. This was desirable because it would make it possible to have the numbers broadcast in the early evening news. A short description of the current project is presented and then a summary of the work that led to the early delivery of the Solar Index is given. DOE

N81-10537# Solar Environmental Engineering Co., Inc., Fort Collins, Colo.
ALTERNATIVE SOLAR INDICES
Loren J. Lantz 1 Jul. 1980 15 p
(Contract DE-AC02-77ET-20090)
(DOE/ET-20090/6) Avail: NTIS HC A02/MF A01

Possible alternative Solar Indices which could either be a perturbation from the currently defined Solar Index or possible indices based on current technologies for other media markets are discussed. An overview is given of the current project, including the logic that was utilized in defining its current structure and then alternative indices and definitions are presented and finally, recommendations are made for adopting alternative indices. DOE

N81-10538# Solar Environmental Engineering Co., Inc., Fort Collins, Colo.
SOLAR INDEX GENERATION AND DELIVERY
Loren J. Lantz 1980 19 p
(Contract DE-AC02-77ET-20090)
(DOE/ET-20090/8) Avail: NTIS HC A02/MF A01

The Solar Index, more completely defined as the Service Hot Water Solar Index, was conceptualized during the spring of 1978 with direction from a US Government interoffice agency committee which was headed by the Department of Energy. The purpose was to enhance public awareness of solar energy usability. Basically, the Solar Index represents the percentage of energy that solar would provide in order to heat an 80 gallon service hot water load for a given location and day. The Index is computed by utilizing SOLCOST, a computer program which in addition to solar service hot water systems, has be ability to estimate thermal performance of space heating, cooling, and heat pump systems. It also supplies economic analyses for these solar energy systems. The Index is generated daily for most large metropolitan locations in the country. The definition of the Index, how the project came to be, what it is at the present time, and a plan for the future are presented. DOE

N81-10539# Midwest Research Inst., Golden, Colo.
DEVELOPMENT OF POLYCRYSTAL GaAs SOLAR CELLS Quarterly Technical Progress Report, 1 May - 31 Jul. 1979
D. L. Miller, M. J. Cohen, J. S. Harris, Jr., Joseph Ballantyne, Alfred Hoyte, and Elias Stefanakos Sep. 1979 74 p ref
Prepared in cooperation with Rockwell International Electronics Research Center, Thousand Oaks, Calif., Cornell Univ., Howard Univ., North Carolina Agricultural and Technical State Univ.
(Contract EG-77-C-01-4042)
(DSE-4042-T7; QTPR-2) Avail: NTIS HC A04/MF A01

Investigation of grain boundaries in GaAs, growth of small grained GaAs, and solar cell fabrication on the small grained material continued. Some highlights were the fabrication of MS cells of small grained GaAs grown on Mo, the fabrication of MIS cells using spin on oxides, and the determination of interface state density at a high resistance grain boundary. Initial measurements show that series resistance and shunt leakage seriously degrade the performance of cells made from small grain polycrystal MBE GaAs, leading to efficiencies less than 1 percent. DOE

N81-10540# Midwest Research Inst., Golden, Colo. Solar Research Inst.
CADMIUM SULFIDE/COPPER SULFIDE HETEROJUNCTION CELL RESEARCH Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1979
J. A. Thornton 28 Feb. 1980 35 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T27) Avail: NTIS HC A03/MF A01

Investigation of CdS resistivity control by In doping reveals that the resistivity of CdS coatings deposited from an In doped target by reactive sputtering in an Ar - H2S working gas is very sensitive to the H2S injection rate. This coatings varying in resistivity from 10 to the 3rd power omega-cm to 10 to the -1 power omega-cm were deposited from a target doped with 1 at. % In as the H2S injection rate was varied by only 25%. Microprobe analysis confirmed that the In content in the coatings was identical to that in the target. The resistivity variations are believed to result from variations in the Cd vacancy level and the associated vacancy acceptor compensation of the In donors. The sputter-deposited solar cells fabricated thus far are characterized by a low short circuit current. Cell current voltage characteristics and capacitance voltage measurements under solar illumination indicate that the cause is a poor junction collection efficiency due primarily to a low junction electric field in the heat treated cells. DOE

N81-10541# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
CADMIUM SULFIDE/COPPER SULFIDE HETEROJUNCTION CELL RESEARCH Progress Report, 1 Sep. - 30 Nov. 1979
W. W. Anderson and A. D. Jonath Feb. 1980 38 p refs
(Contracts EG-77-C-01-4042)
(DSE-8033-1/3; LMSC-D-682102) Avail: NTIS HC A03/MF A01

Several all sputter deposited Cu2S/CdS cells were prepared with J sub SC approximately 3 mA/sq cm under simulated AM1 illumination. The best AM1 conversion efficiency obtained is 0.6%. This is shown to be typical of sputtered CdS in Cu2S/CdS cells investigated. The sputtered Cu2S appears to be satisfactory for solar cell applications. Presented evidence indicates that the poor conversion efficiency is due to a low-junction electric field intensity on the CdS side of the heterojunction. A multilayer CdS structure was developed which may allow the tailoring of the junction electric field intensity to a selected high value to obtain high-junction collection efficiency. Other areas of cell development advances included: (1) determination of effect of Cu cones in Cu2S on Cu2S/CdS cell performance; (2) solution

of CdS pinhole problem; and (3) open circuit voltage improvement by heat treatment. DOE

N81-10542# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESIGN OF SOLAR CELLS FOR USE IN PHOTOVOLTAIC/THERMAL COLLECTORS
C. H. Cox, III 16 Nov. 1980 7 p refs Presented at the ASME Winter Ann. Meeting, Chicago, 16-21 Nov. 1980
(Contract De-AC02-76ET-20279)
(DOE/ET-20279/79; CONF-801102-19) Avail: NTIS HC A02/MF A01

A promising design development for combined photovoltaic/thermal (PV/T) collectors is one in which the photovoltaic cell is both the conversion device for electrical energy and the absorber of thermal energy. To accomplish this, the PV cell design is modified to use the approximately 25 percent of the air mass 1 spectrum at lambda greater than 1.1 micrometers that is currently rejected by the cell. The parameters investigated are: cell back metallization, back surface field, texture etching and anti-reflective coating. A model indicating the increase in absorptance as a function of these parameters is presented, together with the results of experimental measurements. Discussion closes with the presentation of a PV/T collector design that incorporates the improved cells, has 10 percent greater thermal output than current PV/T collectors, and exhibits no degradation in electrical output. DOE

N81-10543# Brookhaven National Lab., Upton, N. Y.
FUSION UTILIZATION PROJECTIONS IN THE UNITED STATES ENERGY ECONOMY
J. R. Powell and J. A. Fillo Nov. 1979 89 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51212) Avail: NTIS HC A05/MF A01

Potential uses of fusion technology are presented. Specific topics discussed in some detail are: (1) applications of fusion energy, (2) fusion implementation in the US energy system, (3) reactor performance requirements, (4) technology for electric applications, and (5) technology for synthetic fuel/chemical applications. DOE

N81-10544# Hughes Research Labs., Malibu, Calif.
INDIUM PHOSPHIDE/CADMIUM SULFIDE THIN-FILM SOLAR CELLS Quarterly Technical Progress Report, Jun. - Aug. 1979
K. Zanio Nov. 1979 23 p
(Contract EG-77-C-01-4042)
(DSE-4042-T9; QTPR-1) Avail: NTIS HC A02/MF A01

Cadmium sulfide and InP thin films were prepared by thermal evaporation and planar reactive deposition, respecitvely. Polycrystalline CdS films up to 10 micrometers thick showed absorption losses of less than 10% over the 0.6 to 1.0 micrometer wavelength range. A threefold increase in lateral grain size was achieved when CdS/ITO/GLASS structures were partially recrystallized in flowing H2S/Ar at 550 C. The InP deposited onto (100) InP semi-insulating substrate at substrate temperatures as low as 260 C was n type with room temperature mobilities as high as 15000 sq cm/Vsec. The CdS and InP films were integrated into an all thin film InP/CdS/ITO/GLASS structure. DOE

N81-10545# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
SUPPORTED GROWTH OF POLYCRYSTALLINE SILICON SHEET ON LOW-COST CERAMIC, CARBON, OR REUSABLE SUBSTRATE Quarterly Report, 26 Sep. - 31 Dec. 1979
P. W. Chapman, J. D. Heaps, S. B. Schuldt, and J. D. Zook 1 Feb. 1980 36 p refs
(DSE-4042-T22; QR-1) Avail: NTIS HC A03/MF A01

The first method investigated is the SCIM coating technique. (SCIM is an acronym for Silicon Coating by Inverted Meniscus.) With this technique, a low cost ceramic substrate is silicon coated in a continuous manner by passing the substrate over a molten silicon meniscus which is contained in a narrow fused silica trough. Several mullite substrates were silicon coated with this method. The best coatings were approximately 100 micrometers thick with large columnar grains up to 0.5 cm wide and several cm long. Structural characterization of these coatings shows that these large grains are heavily twinned with boundaries perpendicular to the surface of the layer. Minority carrier diffusion length measurements made on photodiodes fabricated from these coatings indicate diffusion lengths of about 25 sq cm. The short circuit current densities of the diodes were about 23 mA/sq cm, with open curcuit voltages of approximately 0.49 V. DOE

N81-10546# Institute of Gas Technology, Chicago, Ill.
PEAT AS AN ENERGY ALTERNATIVE
D. V. Punwani Jul. 1980 10 p Submitted for publication
(Contract DE-AC01-76ET-10283)
(DOE/ET-10283/T1) Avail: NTIS HC A02/MF A01

Although peat is used as an energy source in some countries including Russia, Ireland, and Finland, it is virtually unexploited in many countries such as the United States. An understanding of peat: its varieties, abundance, and distribution; its value as an energy alternative; its current and future role as an energy alternative; and the environmental and socioeconomic impacts of large-scale peat utilization are provided. DOE

N81-10547# Franklin Pierce Law Center, Concord, N. H.
SUMMARY OF THE MID-ATLANTIC CONFERENCE ON SMALL-SCALE HYDROPOWER IN THE MID-ATLANTIC STATES: RESOLUTION OF THE BARRIERS IMPEDING ITS DEVELOPMENT
May 1980 105 p Conf. held at Washington, D.C. 4-5 May 1979
(Contract DE-AS02-78RA-04934)
(DOE/RA-04934/04; CONF-7905174-Summ) Avail: NTIS HC A06/MF A01

The workshop was conducted to bring together interested persons to examine and discuss the major problems associated with small scale hydroelectric dam development in the Mid-Atlantic region. The objectives and the materials available to conference participants were outlined. Two of the workshops discussed problems and policy responses raised by state and federal regulation. The other two workshops concerned economic issues confronting small scale hydro development and the operation and usefulness of the systems dynamics model under development by the Thayer School of Engineering at Dartmouth. Various Federal and state programs designed to stimulate small scale hydro development were discussed. A plenary session completed the workshops. DOE

N81-10548# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
COMPRESSOR PERFORMANCE AT HIGH SUCTION TEMPERATURES WITH APPLICATION TO SOLAR HEAT PUMPS
Edward A. Kush 1980 10 p refs Presented at Purdue Compressor Technol. Conf., West Lafayette, Ind., 23-25 Jul. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27962; CONF-800748-1) Avail: NTIS HC A02/MF A01

The performance of the heat pump and its components under conditions attendant to series solar input to the evaporator is being investigated. Particular emphasis was placed on the details of the compressor performance, since in order to properly exploit the thermodynamic potential of high solar input temperatures (40 to 100 F), the compressor must operate efficiently over a wide range of (saturated) suction temperatures most of which are well above those for which present compressors are designed. Two reciprocating compressors were tested: an open type driven by a 2 speed motor and a hermetic 2 speed, the multispeed feature providing capacity control, which is a virtual necessity for effective use of solar source. The results to date of the compressor aspects of the solar heat pump experiments are described, and the general application of heat pumps and their compressors to use with solar input are discussed. DOE

N81-10549# Battelle Pacific Northwest Labs., Richland, Wash.
STRONTIUM HEAT SOURCE DEVELOPMENT PROGRAM Quarterly Report, Jan. - Mar. 1980
H. T. Fullam Apr. 1980 15 p
(Contract DE-AC06-76RL-01830)
(PNL-1845-46) Avail: NTIS HC A02/MF A01

Sectioning of the capsules from the 30,000-h tests with 90SrF2 was completed and examination of the test specimens

is under way. Metallographic examination of specimens taken from the WESF 90SrF2 capsule that was held at about 800 C for three years was completed. Attack of the Hastelloy C-276 was not significantly greater than that observed in the WESF capsule held at 800 C for 5000 hours. Hydrostatic pressure testing (14,500 psi), puncture (percussion) testing, and thermal testing (800 C) of as-fabricated prototype Hastelloy S and Hastelloy C-4 outer capsules were completed. Preliminary examination of the capsules indicates that none suffered any damage as a result of the tests. DOE

N81-10550# PFR Engineering Systems, Inc., Marina Del Rey, Calif.

SOLAR CENTRAL RECEIVER REFORMER SYSTEM FOR AMMONIA PLANTS Final Technical Report

Jul. 1980 449 p refs

(Contract DE-AC03-79SF-10735)

(DOE/SF-10735/1) Avail: NTIS HC A19/MF A01

Details of the conceptual design, economic analysis, and development plan for a solar central receiver system for retrofitting the Valley Nitrogen Producers, Inc., El Centro, California 600 ST/SD Ammonia Plant are presented. The retrofit system consists of a solar central receiver reformer (SCRR) operating in parallel with the existing fossil fired reformer. Steam and hydrocarbon react in the catalyst filled tubes of the inner cavity receiver to form a hydrogen rich mixture which is the syngas feed for the ammonia production. The SCRR system displaces natural gas presently used in the fossil reformer combustion chamber. The solar reformer retrofit system characteristics and its interface with the existing plant are simple, incorporating state of the art components with proven technology. A northfield composed of one thousand forty second generation heliostats provides solar energy to the receiver which is positioned on top of a 90 meter high steel tower. The overall economics of this system can provide over 20% discount cash flow rate of return with proper investment and market conditions. DOE

N81-10551# PFR Engineering Systems, Inc., Marina Del Rey, Calif.

SOLAR CENTRAL RECEIVER REFORMER SYSTEM FOR AMMONIA PLANTS Final Report

Jul. 1980 65 p refs

(Contract DE-AC03-79SF-10735)

(DOE/SF-10735/1-Summ) Avail: NTIS HC A04/MF A01

An overview of a study to retrofit the Valley Nitrogen Producers, Inc., El Centro, California 600 ST/SD Ammonia Plant with Solar Central Receiver Technology is presented. The retrofit system consists of a solar central receiver reformer (SCRR) operating in parallel with the existing fossil fired reformer. Steam and hydrocarbon react in the catalyst filled tubes of the inner cavity receiver to form a hydrogen rich mixture which is the syngas feed for the ammonia production. The SCRR system will displace natural gas presently used in the fossil reformer combustion chamber. DOE

N81-10552# RAND Corp., Santa Monica, Calif.

QUANTITATIVE EVALUATION OF CLOSED-CYCLE OCEAN THERMAL ENERGY CONVERSION (OTEC) TECHNOLOGY IN CENTRAL STATION APPLICATIONS

E. C. Gritton, R. Y. Pei, J. Aroesty, M. M. Balaban, C. Gazley, R. W. Hess, and W. H. Krase May 1980 139 p refs

(Contract DE-AC01-79PE-70078)

(RAND/R-2595-E; LC-80-13615; ISBN-0-8330-0222-8) Avail: NTIS HC A07/MF A01

Closed cycle Ocean Thermal Energy Conversion (OTEC) for delivery of electric power to the United States is studied. Performance and costs of complete commercial OTEC systems are analyzed at the system level using inputs from component analyses and thermal resource data for sites in the Gulf of Mexico. Such sites could feed the Gulf Coast from the west coast of Florida to the New Orleans areas. In this evaluation, the energy conversion analysis, i.e., the study of the power system, is based on a thermodynamic analysis of the complete system, which includes allowances for losses in all circuits. A cost minimization scheme is used to ensure that the cycle component choices are near optimal. To make these cost minimization calculations, cost algorithms are developed for the principal components. Off design operations are of great importance in the Gulf of Mexico because of significant seasonal surface temperature variations and the quite large resulting variations of output power. DOE

N81-10553# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

OPTIMAL CONTROL STUDIES OF SOLAR HEATING SYSTEMS

C. Byron Winn [1980] 119 p refs

(Contracts DE-AS02-77CS-34519; EG-77-S-02-4519)

(COO-4519-1) Avail: NTIS HC A06/MF A01

The control scheme that is used in a solar heated building has an effect on the performance of the solar system and presents several problems. The first of these is to control the inside temperature of the building and to minimize the fuel consumption. This applies to both solar and conventionally heated buildings. The second problem is to control the collector fluid flow to maximize the difference between the useful energy collected and the energy required to pump the fluid. The third problem is to control the enclosure temperature of a building which has two sources of heat, one solar and the other conventional. DOE

N81-10554# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.

NOVEL CONCEPTS IN ELECTROCHEMICAL SOLAR CELLS Quarterly Progress Report, 15 May - 15 Jul. 1979

J. DuBow 1979 15 p refs

(Contract DE-AC02-77CH-00178)

(SERI/PR-8802-9-T1; QPR-1) Avail: NTIS HC A02/MF A01

An efficient, operational photoelectrochemical cell system involving molten salt (and/or highly concentrated, inorganic, nonaqueous) electrolytes, and the semiconductor electrode materials such as CuTnS2, CuInSe2, MoS2, MoSe2, etc., was developed and evaluated. As a direct consequence, the stages of the work program that are most critical at this time are the electrode fabrication and characterization and the electrolyte preparation and characterization phases. It was demonstrated for the first time that a semiconductor electrode exhibits quite large photoeffects in a cell containing a molten salt electrolyte. The constraints and advantages of this type of electrolyte are being explored from the standpoint of efficiency, corrosion of the electrode, and the chemical and physical properties related to overall cell performance. DOE

N81-10555# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.

NOVEL CONCEPTS IN ELECTROCHEMICAL SOLAR CELLS Quarterly Progress Report, 15 Aug. - 15 Oct. 1979

J. DuBow, R. Job, Rajeshwar Krishnan, and Bob Gale 1979 36 p refs

(Contract DE-AC02-77CH-00178)

(SERI/PR-8802-9-T2; QPR-2) Avail: NTIS HC A03/MF A01

It is considered that the short term stability of n-GaAs PEC's in a ferrocene based, ambient temperature molten salt electrolyte is reasonably good. However, longer term evaluation is required to determine the extent and significance of corrosion, stability, etc. Design parameters for PEC's of any kind have not been quantitatively delineated and present consideration will be given to models for PEC solar cells and limitations caused by ion transport in the electrolyte. The MoSe2 and MoS2 electrodes appear to have substrate reproducibility and transport limitations that make them unsuitable candidates for efficient PEC's at this time. Similarly, the lack of availability of high quality CuInSe2 and CuInS2 substrates limits the quantitative experimental evaluation of their utility for PEC applications. Attenuation is focused on CdSe/CdTe mixtures and CdS as electrodes as well as Si and GaAs in molten salt and polyelectrolyte solutions. The system for solar cell evaluation and network analysis of substrates and cells was mode operational. Preliminary work on economic and theoretical modelling was begun. DOE

N81-10556# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.

NOVEL CONCEPTS IN ELECTROCHEMICAL SOLAR CELLS Quarterly Progress Report, 15 Nov. 1979 - 15 Jan. 1980

J. DuBow, R. Job, and Rajeshwar Krishnan 1980 32 p refs

(Contract DE-AC02-77CH-00178)

(SERI/PR-8802-9-T3; QPR-3) Avail: NTIS HC A03/MF A01

The room temperature molten salt electrolyte in terms of

its overall performance for photovoltaic cells was evaluated. Mass transport processes may prove to be the rate-limiting factor for such electrolytes, unless the concentration of the photoactive redox component can be increased and the solvent viscosity reduced. Acid base surface chemistry of n-GaAs as occurs in aqueous systems, was found present. An analysis reveals that although some of the criteria for an electrolyte are definable precisely, others do require empirical experimentation. It can be concluded that relatively few electrolytes in current use are adequate and it would appear that greater efforts to develop electrolytes would be advantageous. The various types of electrolytes that could be used for PEC's were identified. Good quality MoSe2 single crystals can be grown and short circuit currents greater than previously reported were achieved in an I2/I(-)/Pt cell. A technique to produce photoactive films by anodization is being investigated, initially for the formation of polycrystalline MoSe2 layers. DOE

N81-10557# Swedlow, Inc., Garden Grove, Calif.
DEVELOPMENT OF A 10X LENS CONCENTRATOR Status Report, 1 Apr. 1978 - 31 Mar. 1980
David Holdridge DOE May 1979 35 p
(Contract EM-78-C-04-4197)
(ALO-4197-T2) Avail: NTIS HC A03/MF A01

Many linear and circular lens designs were tested to verify both predicted and field test results. Analyzer test results confirm existing data on energy distribution, but yield lower lens efficiencies than expected. Approximately 15 to 20% of the energy exiting the lens is not being detected at the focal plane. It is thought that the chopped beam leaving the lens centerline and the periphery is resulting in a phase shift problem with the detector. Tests are in progress to determine and cure the test problems. Nearly all performance predictions for the three candidate lens designs were completed. These designs include: plano convex lenses; bi-convex lenses; and convex-concave lenses. DOE

N81-10558# Sperry Univac, St. Paul, Minn.
SOLAR COLLECTOR STUDIES FOR SOLAR HEATING AND COOLING APPLICATIONS Final Report
J. H. Anderson (Sunsource Systems Co.), S. O. Jensen, and J. E. Kovacic Jan. 1980 72 p refs
(Contract EM-78-C-04-5355)
(ALO-5355-T2) Avail: NTIS HC A04/MF A01

A summary of the literature, especially patent teachings pertaining to black fluid solar collectors is given. Laboratory tests to determine the suspension stability of various carbon types in water/Propylene glycol are reported. The suspensions were aged at 160 F for 3600 hours and at -15 F for 1100 hours. It is suggested that the suspending agent interacts with electrical charges on the carbon particles to prevent agglomeration. The liquid was tested for its operating characteristics with several collector design variables using glass tubes as the containment system. The collectors were installed in a house previously operated on a black liquid system, and observed for a six month period with the weather ranging from -12 F to 94 F with no major problems occurring with either the liquid or the collectors. DOE

N81-10559# California Univ., Berkeley. Lawrence Berkeley Lab.
EXPERIMENTAL AND THEORETICAL STUDIES OF THERMAL ENERGY STORAGE IN AQUIFERS
Chin Fu Tsang, Fred J. Molz (Auburn Univ.), and A. David Parr (Auburn Univ.) May 1980 6 p refs Presented at the 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 17-22 Aug. 1980
(Contract W-7405-eng-48)
(LBL-10889; CONF-800806-33) Avail: NTIS HC A02/MF A01

A coupled experimental and theoretical study of thermal energy storage in an aquifer is described. Water at an average temperature of 55 C is stored in a confined aquifer near Mobile, Alabama. Approximately 55,000 cubic meters of water was injected, stored, and then produced for two consecutive cycles. Data obtained were used to validate a numerical model, CCC. This model is able to calculate heat and fluid flow in a three dimensional, liquid saturated system. Without adjusting any parameters, the calculated results reproduce closely the observed data. The energy recovery factor of 66% for the first cycle and 76% for the second cycle indicate that the aquifer may be a very promising thermal energy storage medium. Furthermore, the thermohydrological processes involved appear to be properly accounted for by the numerical model, thus giving us some confidence in the current state-of-the-art in the performance forecast of future aquifer energy storage projects. DOE

N81-10560# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL ENERGY STORAGE TECHNOLOGY PROJECT Annual Report for 1979
T. M. Barlow, W. T. Crothers, D. M. King, J. A. Rinde, T. T. Chiao, S. V. Kulkarni, and D. N. Frank 1 May 1980 151 p
(Contract W-7405-eng-48)
(UCRL-50056-79) Avail: NTIS HC A08/MF A01

The aim of the mechanical energy storage technology project is to demonstrate its potential for energy savings in vehicular and stationary systems. Primary emphasis is on flywheel energy storage systems. In house research and development work includes development and evaluation of the tapered thickness flywheel rotor concept and characterization of fiber composite materials for application to flywheel systems. The activities were organized into the following tasks: transportation applications; photovoltaic and wind applications; fiber composite materials technology; flywheel rotor and containment technology; advanced component technology; and project management and DOE support. DOE

N81-10561# Brookhaven National Lab., Upton, N. Y.
IMPROVED ALKALINE HYDROGEN/AIR FUEL CELLS FOR TRANSPORTATION APPLICATIONS
J. McBreen, G. Kissel, K. V. Kordesch, F. Kulesa, E. J. Taylor, E. Gannon, and S. Srinivasan 1980 6 p refs Presented at 15th Intersoc. Energy Conversion Eng. Conf., Seattle, 18-22 Aug. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28094; CONF-800806-32) Avail: NTIS HC A02/MF A01

Some alkaline air electrodes for air depolarized chloralkali cells were evaluated at Brookhaven National Laboratory in alkaline hydrogen/air fuel cells. In initial tests with 289 sq cm electrodes, power densities of 100 mW/sq cm were obtained at 0.65 V. This compares with power densities of 27 mW/sq cm obtained by Kordesch in his vehicle fuel cell in the late sixties. Further improvements in the air electrode flow field yielded power densities of 126 mW/sq cm at 0.65 V at an operating temperature of 70 C. At 30 C, nearly 60% of this power could be obtained at 0.65 V. The 289 sq cm cells were units in a 16 cell 0.5 kW module. This module yielded similar power densities, and its power/weight and power/volume are sufficiently attractive for it to be considered as a building block for a fuel cell power plant in a fuel cell/battery hybrid vehicle. DOE

N81-10562# Sandia Labs., Albuquerque, N. Mex.
FINITE ELEMENT STRATEGIES FOR THE EFFICIENT ANALYSIS AND EVALUATION OF SOLAR COLLECTOR STRUCTURES
J. R. Koteras and Richard James 1980 13 p refs Presented at 1st Chautauqua on Finite Element Modeling and MSC/Nastran, Cape Cod, Mass., 15 Sep. 1980
(Contracts DE-AC04-76DP-00789; AT(29-1)-789)
(SAND-80-0381C; CONF-800925-1) Avail: NTIS HC A02/MF A01

Concentrating or reflecting structures for solar energy systems must be evaluated as to their structural integrity and optical performance. Computer studies can be used as an integral part of these evaluations. The computer studies make use of finite element structural codes coupled with post-processors that calculate optical data. If the analysis of a solar structure is to be carried out in an efficient manner, these computer codes must have certain capabilities. A number of solar energy projects at Sandia National Laboratories make extensive use of finite element methods to evaluate design concepts which hold promise for large scale use in solar energy projects. Analysis procedures for heliostats and parobolic reflectors are considered. DOE

N81-10563# *Societe Nationale Industrielle Aerospatiale, Les* Mureaux (France). Div. Systemes Balistiques et Spatiaux.

HIGH SPEED FLYWHEELS OPERATING ON ONE ACTIVE AXIS MAGNETIC BEARINGS

P. C. Poubeau Paris 1979 11 p refs Presented at 1977 Flywheels Technol. Symp., San Francisco, 5-7 Oct. 1977 *(SNIAS-792-422-107)* Avail: NTIS HC A02/MF A01

The configurations of two momentum wheel were examined: one design for high angular momentum for a low mass, and the other utilizing two center rotating wheels. Several engineering models were built constituting small units able to store energy under kinetic form with input and output of power under electric form. The successful operation of these models demonstrated the compatibility for energy storage systems of high speed rotors with a magnetic suspension. The characteristics of the magnetic suspension and of the rotors which were developed are described. Author (ESA)

N81-10564# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

SYSTEM MODELING USING TRNSYS COMPUTER SIMULATION

N. Connor (Univ. of Southern Calif., Los Angeles) 1980 23 p refs Presented at VKI Lecture Ser. on Heat Exchange and Solar Energy, Rhode-Saint-Genese, Belgium, 28 Jan. - 1 Feb. 1980 *Submitted for publication*

(VKI-Preprint-1980-11) Avail: NTIS HC A02/MF A01

The TRNSYS program contains a collection of mathematical models of solar thermal systems components as separate modules, and is used as a comprehensive tool to simulate and predict system performance when the operating conditions vary continuously with time. An example showing the simulated performance of a swimming pool solar heating system is presented. *Author (ESA)*

N81-10565# National Bureau of Standards, Washington, D.C. *National Engineering Lab.*

AN ECONOMIC MODEL FOR PASSIVE SOLAR DESIGNS IN COMMERCIAL ENVIRONMENTS

Jeanne W. Powell Jun. 1980 150 p refs Sponsored in part by DOE, Washington, D.C.

(PB80-199532; NBS-BSS-125; LC-80-600081) Avail: NTIS HC A07/MF A01; Also avail: SOD CSCL 13A

The model incorporates a life cycle costing approach that focuses on the costs of purchase, installation, maintenance, repairs, replacement, and energy. It includes a detailed analysis of tax laws affecting the use of solar energy in commercial buildings. Possible methods of treating difficult to measure benefits and costs, such as effects of the passive solar design on resale value of the building and on lighting costs, rental income from the building, and the use of commercial space, are presented The model is illustrated in two case examples of prototypical solar design for low rise commercial buildings in an urban setting. GRA

N81-10566# *Office of Technology Assessment, Washington, D. C.*

RECENT DEVELOPMENTS IN OCEAN THERMAL ENERGY

Apr. 1980 40 p refs

(PB80-201825; OTA/TM-003; LC-80-600074) Avail: NTIS HC A03/MF A01 CSCL 10B

The status of Ocean Thermal Energy Conversion (OTEC) technology developments as of April 1980 are reviewed. Major technical accomplishments and principal technical uncertainties that remain are discussed. GRA

N81-10567*# New England Research Application Center, Storrs, Conn.

BATTERY ELECTROLYTES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1972 - Apr. 1980

C. Gilbert Young May 1980 68 p Sponsored by NASA and NTIS

(NASA-CR-163673; PB80-808645) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Many types of solid, liquid, and gaseous battery electrolytes are considered in the 53 cited reports. Battery design, construction, and use, employing the listed electrolytes, are discussed. Battery life, efficiency, and maintenance characteristics are also delineated. GRA

N81-10568# Woods Hole Oceanographic Institution, Mass. Dept. of Physical Oceanography.

SEASONAL PERFORMANCE OF A BRINE POND SOLAR HEAT COLLECTOR IN NEW ENGLAND

William S. VonArx Mar. 1980 34 p *refs*

(Grant NOAA-04-7-158-44104)

(PB80-198278; WHOI-80-16; NOAA-80051304) Avail: NTIS HC A03/MF A01 CSCL 10A

The principles of a modified plot scale Bloch-Tabor brine pond solar heat collector and its operation over the course of a New England winter are described. By stratifying the pond using calcium chloride, a 'cat eye' effect was produced which enabled the pond to act as a whole-sky radiation trap; the freshwater cap served as both an optical and mechanical barrier to heat loss. The pond operated at 24 percent efficiency in collecting solar radiation. The minimum temperature observed in the brine layer at a time when the pond was covered by ice, was 24 C and the summer maximum was 58 C. Modifications to full scale systems, their shortcomings and the environmental constraints associated with this approach are discussed. GRA

N81-10569*# *New England Research Application Center, Storrs,* Conn.

INVERTER CONVERTERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Apr. 1980

Robert Hippler May 1980 106 p Sponsored by NASA and NTIS

(NASA-CR-163649; PB80-809080) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Cited works cover the field of electrical devices which convert direct to alternating current. Some of the applications discussed are motor and furnace drives, solar and wind generated electrical power conversion, variable frequency devices for motor speed control drives, and power frequency conversion devices. The components used in these devices, such as thyristors, SCRs, MOS devices, etc., and the associated circuitries, are described. GRA

N81-10222# Joint Publications Research Service, Arlington, Va.

DESALINATION OF WATER WITH SOLAR POWER

B. Agricola and V. Cena *In its* West Europe Rept.: Sci. and Technol., No. 13 (JPRS-75031) 30 Jan. 1980 p 32-44 Transl. into ENGLISH from Fonti di Energia Alternative (Rome), no. 2, Mar. - Apr. 1979 p 22-27 (For primary document see N81-10219 01-31)

Avail: NTIS HC A03/MF A01

N81-10224# *Joint Publications Research Service, Arlington,* Va.

EEC RESEARCHERS TEST ALTERNATIVE ENERGY TECHNOLOGIES

In its West Europe Rept.: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 1-6 Transl. into ENGLISH from Wirtschaftswöche (West Germany), no. 38, 17 Sep. 1979 p 46-52 (For primary document see N81-10223 01-31)

Avail: NTIS HC A05/MF A01

N81-10226# Joint Publications Research Service, Arlington, Va.

IMPROVED USE, REUSE OF SPENT OIL PROPOSED

In its West Europe Rept.: Sci. and Technol., No. 3 (JPRS-74565) 14 Nov. 1979 p 12-15 Transl. into ENGLISH from Unsere Umwelt (Vienna), no. 32, 1979 p 23-24 (For primary document see N81-10223 01-31)

Avail: NTIS HC A05/MF A01

N81-10500# Joint Publications Research Service, Arlington, Va.

WORLD'S FIRST SOLAR POWER STATION IN CATANIA

Taddeo Canca *In its* West Europe Rept.: Sci. and Technol., No. 14 (JPRS-75070) 5 Feb. 1980 p 20-22 Transl. into ENGLISH from Unita (Milan), 3 Dec. 1979 p 7 (For primary document see N81-10497 01-42)

Avail: NTIS HC A04/MF A01

N81-10501# Joint Publications Research Service, Arlington, Va.
OBSTACLES TO DEVELOPMENT OF PASSIVE SOLAR SYSTEMS
Aldo Fanchiotti *In its* West Europe Rept.: Sci. and Technol., No. 14 *(JPRS-75070)* 5 Feb. 1980 p 23-34 *refs Transl.* into ENGLISH from Fonti de Energia Alternative (Rome), Jul. - Aug. 1979 p 54-59 (For primary document see N81-10497 01-42)
Avail: NTIS HC A04/MF A01

N81-10502# Joint Publications Research Service, Arlington, Va.
USE OF HYDROGEN TO STORE, TRANSMIT POWER
Paolo Boccanera, Andrea Moriconi, and Antonio Naviglio *In its West Europe Rept.: Sci. and Technol., No. 14 (JPRS-75070)* 5 Feb. 1980 p 35-51 refs Transl. into ENGLISH from Fonti di Energia Alternative (Rome), no. 2, Mar. - Apr. 1979 p 14-21 *(For primary document see N81-10497 01-42)*
Avail: NTIS HC A04/MF A01

N81-10997# Joint Publications Research Service, Arlington, Va.
***INDUSTRIAL ENERGY CONSERVATION TECHNIQUES* EXPLORED**
G. Baller *In its* West Europe Rept: Sci. and Technol., No. 5 *(JPRS-74642) 27 Nov. 1979 p 41-46 Transl. into ENGLISH* from Energie, Graefefling, West Germany nos. 8-9, Aug. - Sep. 1979 p 110-114 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

N81-11000# *Joint Publications Research Service, Arlington, Va.*
USE OF NUCLEAR POWER FOR COAL CONVERSION *PROPOSED*
In its West Europe Rept.: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 62-65 Transl. into ENGLISH from Energie (Graefelfing, West Germany), Jul. 1979 p 264 *(For primary* document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; *environment monitoring; and contamination control.*

N81-10570 Arkansas Univ., Fayetteville.
RADON DAUGHTERS IN THE ATMOSPHERE *Ph.D. Thesis*
Chung-King Liu 1980 123 p
Avail: Univ. Microfilms Order No. 8026030

A marked increase in the ratio of Po-210 to Pb-210 in atmospheric precipitation observed at Fayetteville (36 N, 94 W), *Arkansas, in winter seems to be attributable to a brewer-Dobson-*type global circulation of air masses rather than to atmospheric injections of excess Po-210 from sources such as volcanic eruptions, soil particles, and/or plant exudates. The activities of Pb-210, Bi-210, and Po-210 were measured in 46 samples which were collected at Fayetteville, Arkansas, during the months of July 1977 through December 1979. In approximately 72 percent of the cases (33 out of 46 rains), the residence time calculated from the Bi-210/Pb-210 and Po-210/Pb-210 ratios were either concordant or near concordant. The discordant residence times in 28 percent of the cases (13 out of 46 rains) can be shown to result from the mixing of two different air masses: one represented by a short and the other by a much longer residence time of the radon daughters. Dissert. Abstr.

N81-10571 Stanford Univ., Calif.
ON THE APPLICATION OF OPTICAL COPUTED TOMOGRAPHY TO REMOTE AIR POLLUTION Ph.D. Thesis
David Conrad Wolfe, Jr. 1980 172 p
Avail: Univ. Microfilms Order No. 8024760

The use of tomography for the purpose of making remote air pollution measurements over metropolitan areas is proposed. This method would employ a laser source in a novel geometry that permits the simulation of a conventional fan beam scan. A *computer simulation of this 'virtual source' optical computed* tomography is described in the sequel. The reconstruction accuracy, required line integral sampling densities, average signal *to noise properties, sensitivity to input disturbances, cloud* detection sensitivity and artifact properties are studied. Pollution clouds can be reconstructed with better total range, range *resolution, signal to noise, and lower required laser power than* with current differential absorption laser radars. Dissert. Abstr.

N81-10572 Stanford Univ., Calif.
CADMIUM, COPPER, AND LEAD IN ESTUARINE SALT *MARSH MICROLAYERS: ACCUMULATION, SPECIATION,* AND TRANSPORT Ph.D. Thesis
Leonard W. Lion 1980 386 p
Avail: Univ. Microfilms Order No. 8024703

The relative importance of complexation with surface active organic ligands, adsorption onto particulate surfaces, and/or biological uptakes are evaluated as reactions *which may control* the air sea interfacial accumulation of toxic trace metals. The *relative importance of the advective flux of surface enriched metals* in their tidal transport between an estuary and its salt marsh borders is also assessed. Computer simulation of trace metal *speciation with an equilibrium computer model (REDEOL) was* performed to provide a conceptual framework for the evaluation of field data. Results show increasing association of metals in *the rank order cadmium, copper, lead with the particulate phase* in samples from the South San Francisco Bay estuary. These results are consistent with the metal speciation calculated in *computer simulated surface microlayers and bulk sea water. The* surface enrichment of cadmium, copper, and lead is observed to be principally related to the surface enrichment of particulate materials. High particulate enrichments originate with entrainment of materials from exposed intertidal mud flats by flood tides.
Dissert. Abstr.

N81-10573 Michigan Univ., Ann Arbor.
***MEASUREMENTS OF OXIDES OF NITROGEN AND NITRIC* ACID IN AMBIENT AIR Ph.D. Thesis**
Thomas Joseph Kelly 1980 232 p
Avail: Univ. Microfilms Order No. 8025704

Measurements of odd nitrogen compounds in the atmosphere *are necessary because of the part these compounds play in the* chemistry of both clean and polluted air. Nitric oxide (NO), and nitrogen dioxide (NO2), are important pollutants because of their *interactions with atmosphere free radicals and ozone. Odd nitrogen* compounds are removed from the atmosphere in the form of nitric acid (HNO3). The technique of gas phase chemiluminescence was used to measure *NO and NO2 in ambient air. The* chemiluminescent method was adapted to measure HNO3 by *thermally reducing HNO3 to NO2 in a heated quartz converter* tube, and further reducing NO2 to NO for detection, using granular FeSO4. The result is a rapid, sensitive detector for simultaneous *measurements of NO, NO2, and NO3. The instrument was used* both in polluted urban air, and in a six month measurement program in clean air at a remote site in the Rocky Mountains. The concentration in clean continental air is approximately 0.25 ppbv and a significant diurnal variation around this mean value exists. Dissert. Abstr.

N81-10574 Pennsylvania State Univ., University Park.
A MODEL OF THE FORMATION OF ACID IN COAL-FIRED POWER PLANT PLUMES Ph.D. Thesis
Carl Robert Chelius 1980 114 p
Avail: Univ. Microfilms Order No. 8024435

A one dimensional model was constructed to predict the growth and acidity of droplets in the stack plumes of coal fired power plants. Standard cloud physics droplet growth equations were applied to the droplet size section of the model and a noncatalytic oxidation of SO2 in an aqueous solution was used to predict the hydrogen ion concentration. Sensitivity tests were performed on the model and it was found that any factor which increased droplet growth (relative humidity, increase of solute in the droplet, for example) increased the pH of the droplet. The amount of gaseous ammonia in the atmosphere also has an effect on the pH. The model was checked to see if dispersion or dilution of the plume would change the predicted values.

The model was applied to conditions simulating stratus and cumulus clouds. Two 'special cases' were modeled. A low pH situation where conditions were specified which kept droplet growth at a minimum in the presence of low ammonia amounts and a situation where the stack plume merged with the cooling tower plume about 500 m downwind from the source.
Dissert. Abstr.

N81-10575 Arkansas Univ., Fayetteville.
AERODYNAMIC RELAXATION TIME ANALYSIS OF PARTICULATES USING ELECTRICAL EXCITATION Ph.D. Thesis
Robert Garland Renninger 1980 161 p
Avail: Univ. Microfilms Order No. 8025995

An electrical single particle aerodynamic relaxation time (SPART) analyzer was developed that can make real time measurements of the aerodynamic diameter or electrical charge of individual aerosol particles in the size range of 0.5 to 2 micron m. The instrument operates by electrically charging the particles, subjecting them to an oscillatory electric field and then measuring their induced motion with a laser Doppler velocimeter (LDV). Particle inertia causes a phase lab between the driving electric field and the particle's motion. The amount of the phase lag is determined by the aerodynamic diameter. The magnitude of the induced oscillatory velocity is determined by the particle's charge. The microcomputer controlled signal processing circuits of the breadboard analyzer measure either the velocity amplitude or the phase lag of each particle that passes through the LDV sensing volume. The microcomputer stores the measured values and creates a record of all the data using a paper tape punch. Subsequent data processing generates the charge or aerodynamic size spectrum of the aerosol. Dissert. Abstr.

N81-10576*# National Aeronautics and Space Administration, Washington, D. C.
SURVEY POPULATION RESPONSE TO AIRPLANE NOISE, PART 1
C. Bitter and K. W. Schwager May 1980 71 p Transl. into ENGLISH from Enouete Reacties Bevolking op Vliegtuiglawaai, (Leiden), Aug. 1964 69 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Institute for Health Techniques, TNO, Netherlands
(Contract NASw-3199)
(NASA-TM-75790; Rept-D-19) Avail: NTIS HC A04/MF A01 CSCL 13B

A questionnaire concerning aircraft noise is presented. The tabulated responses to it are also presented. T.M.

N81-10577*# National Aeronautics and Space Administration, Washington, D. C.
ANNOYANCE FROM LIGHT AIRCRAFT INVESTIGATION CARRIED OUT AROUND FOUR AIRPORTS NEAR PARIS
Apr. 1980 55 p refs Transl. into ENGLISH of La gene causee par laviation legere-enquete effectuee autour de quatre aerodromes de la region parisienne Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre Ketudes et de Recherches Pyschologiques Air and Analyse, Recherche et Conseil en Marketing et Communication (Paris)
(Contract NASw-3199)
(NASA-TM-75823) Avail: NTIS HC A04/MF A01 CSCL 13B

An opinion survey was carried out on residents living near four airports in the Paris, France area. An evaluation of their responses concerning noise pollution and possible expansion of airport activity is presented. L.F.M.

N81-10578# Committee on Public Works and Transportation (U. S. House).
AVIATION SAFETY AND NOISE ABATEMENT
Washington GPO 1979 448 p refs Hearings on H. R. 2458, H. R. 3547 and H. R. 3596 Before the Subcomm. on Aviation of the Comm. on Public Works and Transportation, 96th Congr., 1st Sess., 24 Apr. and 1 May 1979
(GPO-50-923) Avail: Subcommittee on Aviation

The 1979 hearings before the House subcommittee on aviation considering legislation to establish noise reduction and safety programs are presented. Three bills are introduced and examined, the general proposal of each being to provide Federal assistance to airport operators to prepare and carry out noise compatibility programs and to provide assistance to assure continued safety in aviation. Both indirect methods of noise abatement involving land use and flight pattern control and direct aircraft engineering investigations are addressed. M.G.

N81-10579# Committee on Foreign Relations (U. S. Senate).
ENVIRONMENTAL MODIFICATION TECHNIQUES
Washington GPO 1979 44 p refs Hearing before the Comm. on Foreign Relations, 96th Congr., 1st Sess., 10 May 1979
(GPO-46-127) Avail: Committee on Foreign Relations

The Senate hearing before the Committee on Foreign Relations concerning the convention on the prohibition of military or any other hostile use of environmental modification techniques is presented. Four specific modifications of the previous U.S. position are discussed which would (1) broaden the scope of the convention to prohibit the military or other hostile use of environmental modification techniques against any nation not limited to other parties to the convention; (2) eliminate the threshold requirement that the effects of the environmental modification be widespread, long-lasting, or severe; (3) incorporate a ban on research, development, and testing of environmental modification techniques except for techniques which could have legitimate civilian use; and (4) incorporate a ban on the use of environmental modification techniques to enhance the effectiveness of conventional weapons. M.G.

N81-10580# Air Force Engineering and Services Center, Tyndall AFB, Fla. Environics Div.
FUEL JETTISONING BY U.S. AIR FORCE AIRCRAFT. VOLUME 1: SUMMARY AND ANALYSIS Final Technical Report, Feb. 1972 - Dec. 1979
Harvey J. Clewell, III Mar. 1980 60 p refs
(AF Proj. 1900)
(AD-A089010; AFESC/ESL-TR-80-17-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 13/2

An analysis of 3 1/2 years of data on fuel jettisoning by US Air Force aircraft was performed to provide the basis for an accurate assessment of the environmental effects associated with this practice. The nature and extent of US Air Force jettisoning was examined, and the principal commands, aircraft, locations, altitudes, and quantities were identified. The reasons for fuel jettisoning were also investigated, and the relative importance of fuel jettisoning as a source of hydrocarbon pollution was estimated, considering both the possibility of ground contamination by liquid fuel, and the potential for production of photochemical oxidant pollution from the vapors. The analysis indicates that current Air Force policies concerning fuel jettisoning are adequate to minimize any negative environmental consequences, and that Air Force operational practices are in keeping with these policies. Fuel jettisoning as carried out by Air Force aircraft does not appear to produce any serious environmental consequences.
GRA

N81-10581# Air Force Engineering and Services Center, Tyndall AFB, Fla. Environics Div.
FUEL JETTISONING BY U.S. AIR FORCE AIRCRAFT. VOLUME 2: FUEL DUMP LISTINGS Final Technical Report, Feb. 1972 - Dec. 1979
Harvey J. Clewell, III Mar. 1980 186 p refs 2 Vol.
(AF Proj. 1900)
(AD-A089076; AFESC/ESL-TR-80-17-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 13/2

An analysis of 3 1/2 years of data on fuel jettisoning by US Air Force aircraft was performed to provide the basis for an accurate assessment of the environmental effects associated with this practice. This volume contains complete listings of all reported fuel dumps by Air Force aircraft for the period 1 Jan 75 through 30 Jun 78, sorted by Air Force command and by aircraft. A third section presents the distribution of fuel jettisoning by latitude and longitude coordinates. GRA

N81-10582# Hunter Coll., New York. Dept. of Geology and Geography.
BEACH USE AND WATER QUALITY IN NEW YORK CITY
Charles Heatwole and Niels West (Rhode Island Univ., Kingston) Albany, N.Y. New York Sea Grant Inst. Feb. 1980 22 p

refs
(PB80-204084; NOAA-80052715; NYSG-RS-80-2) Avail: NTIS HC A02/MF A01 CSCL 13B

The major goal of Project 208 (Waste Treatment Management Plan) is to eliminate the sources of pollution and open new beach areas. Emphasis is focused on the impact Project 208 might have for swimming and beach use in the New York City area. GRA

N81-10583# Army Construction Engineering Research Lab., Champaign, Ill. Environmental Div.

ENVIRONMENTAL INFORMATION ACQUISITION AND MAINTENANCE TECHNIQUES: REFERENCE GUIDE Final Report

Robert E. Riggins, V. T. Young, and W. D. Goran Aug. 1980 41 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A089136; CERL-TR-N-96) Avail: NTIS HC A03/MF A01 CSCL 06/6

This report provides a guide to techniques for collecting, using and maintaining data about each of the 13 environmental technical specialties in the Environmental Impact Computer System (EICS). The technical specialties are: (1) ecology, (2) environmental health, (3) air, (4) surface water, (5) ground water, (6) sociology, (7) economics, (8) Earth science, (9) land use, (10) noise, (11) transportation, (12) aesthetics, and (13) energy and resource conservation. Acquisition techniques are classified by the following general categories: (1) secondary data, (2) remote sensing, (3) mathematical modeling, (4) field work, (5) mapping/maps and (6) expert opinion. A matrix identifies the most appropriate techniques for collecting information on the EICS technical specialties. After selecting a method, the user may read an abstract of the report explaining that technique, and may also wish to obtain the original document for detailed information about applying the technique. Finally, this report offers guidelines on storing environmental information for future use, and on presenting that information effectively in environmental documents. GRA

N81-10584# Argonne National Lab., Ill.

ENVIRONMENTAL CONTROL IMPLICATIONS OF COAL USE

K. E. Wilzbach, C. D. Livengood, and P. S. Farber 17 Mar. 1980 20 p refs Presented at the 2d DOE Environmental Control Symp., Reston, Va., 17-19 Mar. 1980
(Contract W-31-109-ENG-38)
(CONF-800334-18) Avail: NTIS HC A02/MF A01

The Environmental Control Technology for Coal Utilization program provides information required in the planning and guidance of R and D programs for coal utilization technologies and the associated environmental controls. Both available and developing technologies for the entire energy system from the mine mouth through ultimate waste disposal are analyzed. The tools of technology assessment and systems analysis are used to provide balanced evaluations of the engineering, environmental, and economic aspects of the technologies, as well as identification of synergistic effects and secondary or indirect impacts. The assessments performed to date that indicate the nature of the current work are briefly reviewed. The computerized models and data bases utilized in assessments are described. Some of the results from a major ongoing study of environmental controls for industrial boilers are presented and their implications discussed. DOE

N81-10585# California Univ., Berkeley. Lawrence Berkeley Lab.

LEGAL AND INSTITUTIONAL ASPECTS OF REGULATING INTERMEDIA POLLUTION

Robert M. Entman May 1980 83 p refs
(LBL-11177) Avail: NTIS HC A05/MF A01

Intermedia pollution is defined here as the creation of new environmental impacts by controlling existing ones. DOE asked four questions: (1) Do the major environmental laws address intermedia pollution; (2) Does the Environmental Protection Agency (EPA) have rules, regulations, and procedures through which it considers intermedia questions; (3) Do the legislative histories of the laws indicate whether Congress intended for the EPA to consider intermedia issues; and (4) In what ways do the existing laws and regulatory procedures exacerbate intermedia pollution. The answer to the first three questions is yes; much of this report is devoted to amplifying and qualifying that response, the rest to answering the fourth question. A case study of the intermedia implications of recently issued air-pollution standards for coal-fired power plants illustrates the themes concretely. An analysis of policy alternatives for improving intermedia pollution control concludes the study. DOE

N81-10586# National Technical Information Service, Springfield, Va.

URBAN NOISE POLLUTION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Jun. 1980

Edith Kenton Jul. 1980 229 p Supersedes NTIS/PS-79/0689; NTIS/PS-78/0686
(PB80-812779; NTIS/PS-79/0689; NTIS/PS-78/0686) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

Aspects of noise in the urban environment are covered. The topics were chosen for their interest to urban planners and include citizen attitudes, transportation noise, and noise abatement techniques. This updated bibliography contains 220 abstracts, 31 of which are new entries to the previous edition. GRA

N81-10587# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980

Audrey S. Hundemann Aug. 1980 192 p Supersedes NTIS/PS-79/0842; NTIS/PS-78/0789
(PB80-813140; NTIS/PS-79/0842; NTIS/PS-78/0789) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

Application of remote sensing methods to air, water, and noise pollution problems is discussed. Topic areas cover characteristics of dispersion and diffusion by which pollutants are transported, eutrophication of lakes, thermal discharges from electric power plants, outfalls from industrial plants, atmospheric aerosols under various meteorological conditions, monitoring of oil spills, and application of remote sensing to estuarian problems. GRA

N81-10588# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Mechanical Engineering.

WATER AND AIR QUALITY CONTROL WITH A COIL TYPE FILTER

Lawrence K. Wang, Richard S. Magee, and Yao Tang 15 Feb. 1980 62 p refs Sponsored in part by the Blandford Fund, Hoboken, N.J.
(PB80-195662; STI-ME/02-80/2) Avail: NTIS HC A04/MF A01 CSCL 13K

A coil type filter was developed and experimentally evaluated for environmental control. The filter comprises a spiral wound coil with an inlet and an outlet at opposite ends. The inlet and outlet apertures have screens positioned to retain the filtering element within the coil. Couplings are provided on the exterior of the coil at each end for connection to other portions of a fluid flow system. The interior of the coil is filled with adsorbents, absorbents, ion exchange resins, and filter media which perform the purifying operation. The spiral wound coil may be mounted within a housing with the inlet and outlet both extending outwardly from the same portion of the housing. The newly developed coil type filter can adequately remove toxic organics and heavy metals from water. GRA

N81-10589# Southwest Research Inst., San Antonio, Tex.

A STUDY TO IMPROVE EPA METHODS 15 AND 16 FOR REDUCED SULFUR COMPOUNDS Final Report

Henry F. Hamil and Nollie F. Swynnerton Apr. 1980 63 p refs
(Contract EPA-68-02-2489)
(PB80-197346; EPA-600/4-80-023) Avail: NTIS HC A04/MF A01 CSCL 14B

Techniques and procedures for the gas chromatographic measurement of hydrogen sulfide, carbonoxysulfide, carbon disulfide, methylmercaptan, dimethylsulfide and dimethyldisulfide were studied. Absorption of these species on the surfaces of the chromatographic system was found to be the main source

of imprecision and inaccuracy in the analysis. Permeation devices containing the above sulfur compounds were found to permeate at uniform rates after one year of use. Aluminum cylinders containing compressed gas mixtures of the compounds under investigation were analyzed for four months. Results showed them to be stable in some instances and to be promising candidates for quality assurance materials. Comparison of an electrolytic conductivity detector with a flame photometric detector showed the former to be valuable for the analysis of reduced sulfur compounds under laboratory conditions. GRA

N81-10590# NATO Information Service, Brussels (Belgium).
PROCEEDINGS OF THE INTERNATIONAL TECHNICAL MEETING ON AIR POLLUTION MODELING AND ITS APPLICATION
Oct. 1979 723 p refs Conf. held in Rome, 22-26 Oct., 1979
(PB80-196124; NATO/CCMS-108) Avail: NTIS HC A99/MF A01 CSCL 13B

The growing energy demand in industrialized countries requires the construction of an increasing number of power plants fired with sulfur containing fossil fuels in already polluted areas. The construction of high stacks seemed to be the best solution. Standardized Gaussian models if at all suitable, are not yet tested for an application to this problem. Topics covered in 56 papers include: (1) tall stack management and impacts on the atmosphere; (2) complex terrain and weak wind conditions; (3) regional source quantification; (4) mesoscale diffusion; (5) multiple sources; (6) regulation applications; and (7) heavy gases. GRA

N81-10591# Martin Marietta Corp., Baltimore, Md.
COMPARISON BETWEEN PREDICTIONS OF TWO GAUSSIAN MODELS (CRSTER AND MODIFIED CRSTER) AND MEASURED SO2 CONCENTRATIONS NEAR TALL STACKS UNDER CONVECTIVE CONDITIONS Final Report
Roger Brower Jul. 1980 17 p refs
(PB80-197106; PPSP-MP-32) Avail: NTIS HC A02/MF A01 CSCL 13B

The ability of two Gaussian plume models (CRSTER and modified CRSTER) to predict ground-level concentrations are compared. The modified models is found to be much more accurate in convective conditions, particularly because of a plume penetration feature. GRA

N81-10592# Acurex Corp., Mountain View, Calif.
AVAILABLE CONTROL TECHNOLOGY (ACT) FOR STATIONARY NO SUB x SOURCES Final Report
R. Mueller, H. Lips, C. Castaldini, K. Davis, M. Herther, R. Raisoni, and H. VanNoordwyk Dec. 1979 150 p refs
(Contract EPA-68-01-4142)
(PB80-198252; EPA-909/9-79-002; Rept-79-22/EE) Avail: NTIS HC A07/MF A01 CSCL 13B

Engineering evaluations of stationary source nitrogen oxide controls were conducted to support EPA Region 9 in determining whether the emission control rules in the EPA approved State Implementation Plan and the recent revisions for the Los Angeles and San Diego areas represent an adequate level of nitrogen oxide control for stationary sources. This report documents the following: (1) a summary of stationary source NOx emission control rules contained in the SIPs, (2) available Control Technology (ACT) specifications for NOx sources in these areas, (3) and a summary of NOx rules for other areas in the U.S. The ACT specification includes estimates of baseline and controlled emissions levels, the limitations and operational impacts, and the control cost associated with ACT. Sources considered include utility and industrial boilers, gas turbines, internal combustion engines, and industrial processes. Control technologies include several levels of combustion modifications and post combustion cleanup. GRA

N81-10593# Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
MATHEMATICAL MODELS FOR THE ANALYSIS OF MANAGEMENT OF NON-POINT SOURCES OF NITROGEN POLLUTION Project Completion Report, Oct. 1977 - Sep. 1978
Christine A. Shoemaker, Steven Pacenka, and Keith S. Porter May 1980 32 p refs
(Contract DI-14-34-0001-8034)
(PB80-201999; W80-05796; OWRT-A-080-NY(1)) Avail: NTIS HC A03/MF A01 CSCL 08G

Simulated and optimization models were developed to evaluate alternative procedures for controlling nitrate pollution of groundwater in eastern Suffolk County, N.Y. The management alternatives considered are restrictions on land development and augmented sewerage. The optimization model was developed to determine the most economical location of wastewater treatment plants and pipe routes. GRA

N81-10594# Arizona State Univ., Tempe. Dept. of Chemistry.
ANALYSIS OF HOUSTON AEROSOL SAMPLES BY GC/MS (GAS CHROMATOGRAPHY-MASS SPECTROMETRY) METHODS Final Report, Sep. 1978 - Jun. 1979
F. W. Karasek and M. L. Parsons Apr. 1980 63 p refs
(Contract EPA-68-02-2961)
(PB80-196785; EPA-600/2-80-071) Avail: NTIS HC A04/MF A01 CSCL 07D

An analysis procedure developed to give a qualitative and quantitative analysis for organic compounds adsorbed on aerosols collected by Hi-Vol filters was adapted and applied to a similar analysis of aerosols collected by dichotomous filters. Analysis was conducted for five dichotomous samples and two Hi-Vol samples collected in the Houston study. Estimated concentration levels for dichotomous filters of 0.1 to 20 ng/cu m were reported for the 27 organic compounds searched. Compounds detected included carboxylic acid esters, phthalates, n-alkanes and polycyclic aromatic hydrocarbons. Filter and solvent blanks contained compounds in the same or higher quantity ranges as did the filter samples, indicating the teflon elements of the dichotomous filters were not cleaned sufficiently prior to use. GRA

N81-10595# SRI International Corp., Menlo Park, Calif.
ATMOSPHERIC MEASUREMENTS OF SELECTED TOXIC ORGANIC CHEMICALS Interim Report
H. B. Singh, L. J. Salas, A. Smith, and H. Shigeishi Jul. 1980 77 p refs
(Grant EPA-80-59-9001)
(PB80-198989; EPA-600/3-80-072) Avail: NTIS HC A05/MF A01 CSCL 04A

Atmospheric concentrations of 37 selected toxic organic chemicals, including aromatic hydrocarbons, halohydrocarbons, and secondary organic pollutants were measured under varying meteorological and source strength conditions at several urban locations: Los Angeles, California; Phoenix, Arizona; and Oakland, Califorina. Ambient air measurements of these chemicals were conducted from a suitably equipped mobile laboratory using specifically developed analytical techniques. Preliminary results on concentrations and variability, average daily exposure dosage, diurnal behavior, and atmospheric distribution, abundance, and fate are presented. GRA

N81-10596# SRI International Corp., Menlo Park, Calif. America Atmospheric Science Center.
ENAMAP-1 LONG-TERM AIR POLLUTION: ADAPTATION AND APPLICATION TO EASTERN NORTH AMERICA Final Report, 21 Aug. 1978 - 31 Jan. 1980
C. M. Bhumralkar, D. E. Mancuso, D. E. Wolf, R. A. Thuillier, K. C. Nitz, and W. B. Johnson Jul. 1980 103 p refs
(Contract EPA-68-02-2959)
(PB80-199003; EPA-600/4-80-039) Avail: NTIS HC A06/MF A01 CSCL 04A

The long term EURMAP-1 model, was used to calculate monthly, seasonal, and annual distributions of sulfur dioxide and sulfate (SO2 and SO4(2)) concentrations and wet and dry depositions over the eastern United States, as well as over the southern portions of the Canadian provinces of Quebec and Ontario. This geographical area was partitioned into 13 different regions and interregional sulfur exchanges calculated. Model results using emissions and meteorological data for the year 1977 are presented. Calculated and measured values show reasonable agreement and indicate that improvements in the calculated values may be achieved by refinements in the modeling of mixing heights and stability. GRA

N81-10597# Falcon Research and Development Co., Buffalo, N. Y.
STUDY OF AUTOMOTIVE EMISSION CONTROL TECHNOLOGY: EMISSIONS FROM FUTURE IN-USE VEHICLES, 1980-1985 Interim Report
1 Jul. 1980 255 p refs Sponsored by the National Commission on Air Quality Prepared in cooperation with Energy and Environmental Analysis, Inc., Arlington, Va.
(PB80-210230; AQ-7243-2F; IR-6) Avail: NTIS HC A12/MF A01 CSCL 13B

Emission control technologies that will be used on 1980 - 1985 vehicles are described and the types of failures and failure rates emission control system components will most probably experience are examined. The in-use emission levels of these vehicles are projected for several scenarios. GRA

N81-10598# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
GUIDANCE FOR COLLECTION OF AMBIENT NON-METHANE ORGANIC COMPOUND (NMOC) DATA FOR USE IN 1982 OZONE SIP DEVELOPMENT, AND NETWORK DESIGN AND SITING CRITERIA FOR THE NMOC AND NOX MONITORS
Jun. 1980 27 p
(PB80-206030; EPA-450/4-80-011) Avail: NTIS HC A03/MF A01 CSCL 13B

Assistance is given for selecting, siting, and employing NMOC monitoring instruments for use in preparing 1982 Ozone SIPs. Some of the commercially available NMOC continuous monitors can provide data useful for modeling and for development of NMOC abatement strategies, if they are carefully maintained and calibrated. Collection of grab samples of ambient air for subsequent analysis by GC methods may be needed if a photochemical model is to be used, but this may be better done by a contractor. GRA

N81-10599# York Research Corp., Stamford, Conn.
IMPACT OF A PRIMARY SULFATE EMISSION SOURCE ON AIR QUALITY Final Report
K. R. Boldt, C. P. Chang, E. J. Kaplin, J. M. Stansfield, and B. R. Wuebber May 1980 218 p refs
(Contract EPA-68-02-2965)
(PB80-203425; EPA-600/2-80-109) Avail: NTIS HC A10/MF A01 CSCL 13B

A one month study was carried out at an isolated oil fired power plant in New York State to assess the impact of primary sulfate emissions on air quality. Emissions of total sulfate from the source varied from 22 kg/hr per boiler with the sulfuric acid concentration averaging 74% of the total sulfate. Particulate emissions ranged from 12 kg/hr to 70 kg/hr per boiler with between 32% and 67% of the particle mass as the driving force in the magnitude of the primary sulfate emissions. Measurements taken 5 km downwind of the plant indicated a source sulfate contribution of from 30% to 60% of the 24 hr average ambient levels. GRA

N81-10600# Environmental Sciences Research Lab., Research Triangle Park, N.C. Emissions Measurement and Characterization Div.
PASSENGER CAR HYDROCARBON EMISSIONS SPECIATION Final Report
Frank Black and Larry High May 1980 25 p refs
(PB80-203136; EPA-600/2-80-085) Avail: NTIS HC A02/MF A01 CSCL 13B

Emission factors for over 60 individual hydrocarbon compounds were determined for four passenger cars. The cars included a 1963 Chevrolet, a 1977 Mustang, and 1978 Monarch, and 1979 LTD 2. The speciation data are reported for both tailpipe and evaporative emissions. The tailpipe emissions were for the urban driving conditions of the Federal Test Procedure used in motor vehicle certification. The evaporative emissions were for both diurnal and hot soak conditions also prescribed in the Federal Test Procedure for certification. The vehicle tests involved four gasoline fuels of varying composition. GRA

N81-10601# Environmental Sciences Research Lab., Research Triangle Park, N.C. Gas Kinetics and Photochemistry Branch.
IMPACT OF NATURAL HYDROCARBONS ON AIR QUALITY
Joseph J. Bufalini May 1980 70 p refs
(PB80-202377; EPA-600/2-80-086) Avail: NTIS HC A04/MF A01 CSCL 13B

The emissions, reactivities, and ozone forming potential of natural hydrocarbons are discussed. A review of the data available on emission levels for natural hydrocarbons indicates that much more information is needed in order to quantify the absolute emission levels. Ambient air measurements suggest that the previous published value of 9 x 10 to the 8th power ton/yr needs to be lowered to 10 to the 6th power - 10 to the 7th power ton/yr. Since rural areas have very low levels of NOx, vegetative emissions may act as sinks for ozone rather than as sources. All areas investigated show very low levels of natural hydrocarbons, suggesting that even if NOx were available, very low levels of ozone would be produced. Air quality is thus not found to be significantly affected by vegetative emissions. GRA

N81-10602# SRI International Corp., Menlo Park, Calif.
GUIDANCE FOR THE COLLECTION AND USE OF AMBIENT HYDROCARBON SPECIES DATA IN DEVELOPMENT OF OZONE CONTROL STRATEGIES Final Report, May - Dec. 1979
Hanwant B. Singh Apr. 1980 64 p refs
(Contract EPA-68-02-2548; SRI Proj. 8624)
(PB80-202120; EPA-450/4-80-008) Avail: NTIS HC A04/MF A01 CSCL 07D

A standard set of procedures that can be routinely and reliably depended upon to obtain NMHC species composition of the ambient air is given. The need exists for the quantification of ambient HC species, especially as they relate to air quality management applications are discussed. Procedures for site selection, sample collection and storage, calibrations and analysis, and quality assurance and control are described. State-of-the-art HC species analysis techniques are unable to identify 10 to 35 percent of the ambient NMHC burden. Recommendations are made to fill gaps in current knowledge. GRA

N81-10603# Research Triangle Inst., Research Triangle Park, N. C.
EVALUATION OF THE BASIC GC/MS (GAS CHROMATOGRAPHIC/MASS SPECTROMETRIC) COMPUTER ANALYSIS TECHNIQUE FOR POLLUTANT ANALYSIS Final Report
J. E. Bunch, N. P. Castillo, D. Smith, J. T. Bursey, and E. D. Pellizzari 1979 207 p refs
(Contract EPA-68-02-2998)
(PB80-202716; EPA-600/2-80-171) Avail: NTIS HC A10/MF A01 CSCL 07D

The basic gas chromatographic/mass spectrometric/computer technique for the analysis of vapor phase organic compounds collected on a solid sorbent was evaluated. Emphasis was placed on the assessment of performance and improvement in techniques in the following areas: (1) wide bore wall coated columns for organic vapor phase analysis; (2) gas chromatography/negative chemical ionization mass spectrometry/computer analysis of halogenated/hydrocarbons in ambient air; (3) the concentration of vapor phase organics from the atmosphere on solid sorbents (in situ reactions); and (4) qualitative and quantitative analysis of vapor phase organics utilizing the improved technology. GRA

N81-10604# National Bureau of Standards, Washington, D.C. Center for Analytical Chemistry.
RAMAN MICROPROBE ANALYSIS OF STATIONARY SOURCE PARTICULATE POLLUTANTS Final Report, 1 Aug. 1977 - 31 Jul. 1979
John J. Blaha, Edgar S. Etz, and Kurt F. J. Heinrich 1979 33 p refs
(Contracts EPA-IAG-D7-F1186; EPA-IAG-78-D-F0367)
(PB80-202708; EPA-600/2-80-173) Avail: NTIS HC A03/MF A01 CSCL 07D

The application of Raman spectroscopy to the molecular characterization of individual particles from stationary sources is described. The NBS developed Raman microprobe was used to characterize microparticles of oil and coal fired power plant emissions and boiler samples. The samples were examined on an 'as received' basis and the results reported do not take into

account any sample modifications that may have occurred during sample collection. Raman microprobe analyses of a number of dense agglomerations of largely submicrometer particles, from a sample collected by the EPA and described as coal fly ash, show no Raman spectral features to indicate a glassy material when the particles are first exposed to laser excitation. GRA

N81-10605# Technology Service Corp., Santa Monica, Calif.
ANALYSIS OF THE ST. LOUIS RAMS (REGIONAL AIR MONITORING SYSTEM) AMBIENT PARTICULATE DATA, VOLUME 1 Final Report
John Trijonis, John Eldon, John Gins, and George Berglund Feb. 1980 142 p refs
(Contract EPA-68-02-2931)
(PB80-203359; EPA-450/4-80-006A-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 13B

A variety of data analysis methods are used to study the 1976 particulate data from the Regional Air Monitoring System (RAMS) in St. Louis. The aerosol data, collected at ten sites, include hi-vol measurement of total suspended particulate mass, as well as dichotomous sampler measurements of inhalable particulate mass, dichotomous sampler data for eight trace elements (S, Si, Al, Ca, Pb, V, Ti, and Fe) and data for 11 meteorological parameters are also included. The analyses characterize the spatial pattern of particulate matter in and near St. Louis; background aerosol concentrations and particulate transport, temporal patterns of particulate concentrations, the dependence of aerosol concentrations on meteorology; and the relationship between hi-vol data and dichotomous data. GRA

N81-10606# Technology Service Corp., Santa Monica, Calif.
ANALYSIS OF THE ST. LOUIS RAMS (REGIONAL AIR MONITORING SYSTEM) AMBIENT PARTICULATE DATA. VOLUME 2: TECHNICAL APPENDICES
John Trijonis, John Eldon, John Gins, and George Berglund Feb. 1980 115 p
(Contract EPA-68-02-2931)
(PB80-203367; EPA-450/4-80-006B-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 13B

Annual and monthly statistics for particulate and meteorological data are presented for 1976. Maps of particulate elemental concentrations, tables relating particulate element concentrations to site characteristics, and tables of interstations correlations are included. Methodology for the regional upwind/downwind analysis is described and weekend-weekday differences of twelve particulate parameters at the ten RAMS sites are given. Decision trees relating fine and IP to elemental concentrations, decision trees relating TSP, IP, fine, coarse, and eight elemental concentrations to meteorological variables, and decision trees relating IP/TSP ratio to elemental concentrations and meteorology are also presented. GRA

N81-10607# Wisconsin Univ. - Madison. Water Resources Center.
REGIONAL INFERENCES BASED ON WATER QUALITY MONITORING DATA
R. B. Miller, W. Bell, R. Y.-Y. Wang, and O. Ferreiro 1980 113 p refs
(Contract DI-14-34-0001-8053)
(PB80-199698; WIS-WRC-80-05; W80-05797; OWRT-B-103-WIS(2)) Avail: NTIS HC A06/MF A01 CSCL 13B

High frequency temperature variations were measured at seven depths, from the water 3 m, at a point 130 m from the cooling-water outfall of a power plant on Lake Michigan. The data are analyzed using spectra, correlation functions, and probability distributions. The sharp thermal fronts observed in the data are related to the surface thermal fronts seen using airborne infrared scanning, and to laboratory studies of instabilities in mixing layers between uniformly flowing and quiescent fluids. GRA

N81-10608# Aerospace Corp., El Segundo, Calif. Government Support Operations.
FEASIBILITY AND COSTS OF APPLYING NOx CONTROLS ON STATIONARY EMISSION SOURCES IN CALIFORNIA Final Report
P. P. Leo, L. Rossoff, and J. R. Witz May 1980 335 p
(PB80-200355; ARB-R-80-121; ATR-80(7806)-1) Avail: NTIS HC A15/MF A01 CSCL 13B

The feasibility and costs of various NOx control methods, i.e., ammonia based catalytic and non-catalytic reduction systems and low NOx burners, were determined for potential application to selected stationary sources of nitrogen oxides (NOx) emissions in California, primarily in the Los Angeles area. The sources studied included: simple and combined cycle turbines used by electric utilities, an internal combustion engine used in compressing natural gas, an oil refinery process heater, an oil field steam generator used in thermally enhanced oil recovery, a cement kiln, and a glass melting furnace used in the manufacture of flat glass. GRA

N81-10609# Radian Corp., Austin, Tex.
SURVEY OF AIR POLLUTION CONTROL TECHNOLOGY, RESEARCH AND DEVELOPMENT, PUBLIC AND PRIVATE ROLES IN UNDERTAKING AND STIMULATING INNOVATION: SURVEY OF EIGHT AIR POLLUTION CONTROL TECHNOLOGY INNOVATIONS Final Report
May 1980 62 p refs
(Contract NCAQ-15-AQ-7421)
(PB80-199177; AQ-7421-15A; RAD-80-203-003-01) Avail: NTIS HC A04/MF A01 CSCL 13B

Fabric filters; spray drying; atmospheric and pressurized atmospheric fluidized bed combustion; hydrodesulfurization; side stream separators; cat-ox scrubbing; and physical coal cleaning are discussed. Regulatory, political, and market climate concerning air pollution control technology is examined. GRA

N81-10610 Virginia Univ., Charlottesville.
A PROBABILISTIC ASSESSMENT OF HIGHWAY AIR QUALITY IMPACTS Ph.D. Thesis
William Alfred Carpenter 1980 276 p
Avail: Univ. Microfilms Order No. 8024045

Two separate solutions to the problem of estimating the air quality impact of a highway (or group of highways) with respect to not to be exceeded more than once per year air quality standards are presented. It is first demonstrated that year-long Markov chains of clipped air quality levels, which are nonstationary for specified starting times, are stationary for arbitrary random starting times. This result is then used to demonstrate that P(V), the probability of violating a not to be exceeded more than once per year air quality standard, can be expressed as a function of the stationary state and transition probabilities P sub 1 and B sub 01 (where state 1 is the state in which the maximum allowable pollution level specified in the standard is exceeded. It is demonstrated that the maximum likelihood estimators B sub 01 and B sub 01 and thus P(V) can be found from simulation results and that P(V) can be bounded from above by a simple function of P sub 1. These results represent significant improvements over previous methods of ascertaining the impacts of pollution sources. Such methods essentially estimate the expected annual maximum concentration and then compare the estimate to that concentration not be exceeded more than once per year. Dissert. Abstr.

N81-10486*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR DETECTION OF SURFACE OIL ACCUMULATIONS
John E. Estes, Peggy ONeill (California Univ., Santa Barbara), and Michael Wilson (California Univ., Santa Barbara) *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 275-292 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 13B

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N81-10611 Minnesota Univ., Minneapolis.
SIGNAL PROCESSING TECHNIQUES APPLIED TO A SMALL

CIRCULAR SEISMIC ARRAY Ph.D. Thesis
Charles Clinton Mosher 1980 291 p
Avail: Univ. Microfilms Order No. 8025490

The travel time method (TTM) for locating earthquakes and the wavefront curvature method (WCM), which determines distance to an event by measuring the curvature of the wavefront can be combined in a procedure referred to as Apparent Velocity Mapping (AVM). Apparent velocities for mine blasts and local earthquakes computed by the WCM are inverted for a velocity structure. The velocity structure is used in the TTM to relocate events. Model studies indicate that AVM can adequately resolve the velocity structure for the case of linear velocity-depth gradient. Surface waves from mine blasts recorded by the Central Minnesota Seismic Array were analyzed using a modification of the multiple filter analysis (MFA) technique to determine group arrival times at several stations of an array. The advantages of array MFA are that source location need not be known, lateral refraction can be detected and removed, and multiple arrivals can be separated. A modeling procedure that can be used with array MFA is described. Dissert. Abstr.

N81-10612 Stanford Univ., Calif.
SOME ASPECTS OF FRICTIONAL SLIDING AT HIGH NORMAL STRESS Ph.D. Thesis
John David Weeks 1980 181 p
Avail: Univ. Microfilms Order No. 8024753

The experiments described are part of the national effort to understand the mechanics of earthquakes. The amplitude frequency relation or b-value for micro-fracturing events is examined as a precursor to unstable frictional sliding or stick slip. It was found that b-value fell just before unstable slip, indicating an increase in the proportion of large amplitude events leading to stick slip. Pore volume changes in saw cut samples were measured during constant strain rate triaxial loading. It was concluded that the very fine particles produced during shearing of layers of granular materials can contain large amounts of water in the form of adsorbed layers on the particles. It was also found that water is important to the frictional sliding behavior of rocks, and a variety of puzzling phenomena was observed, including increased rate of dilatancy with displacement as creep rate descreases, and stress strain behavior that depends on stress and strain history. Finally, the problem of dynamic pore pressure effects during stick slip was examined. Results indicate that high pore pressure transients can be expected during slip on rock surfaces, and that this could affect the coefficient of kinetic friction by creating a transient lowering or effect normal stress. Dissert. Abstr.

N81-10613 Washington Univ., Seattle.
A NUMERICAL STUDY OF SUDDEN STRATOSPHERIC WARNINGS Ph.D. Thesis
Chih-Ping Flossie Hsu 1980 146 p
Avail: Univ. Microfilms Order No. 8026249

The three dimensional Lagrangian motions during sudden stratospheric warmings are studied using a numerical model adapted from that of Holton (1976). Based upon the theory of Matsuno (1971) the model simulates a warming in terms of the interactions between the zonally averaged flow and the planetary waves which are forced at the lower boundary of the model which is assumed to be at the tropopause level. The Lagrangian motions are then studied by following the motions of rings of particles which are placed along latitude circles before the wave forcing is turned on. Dissert. Abstr.

N81-10614 North Carolina State Univ. at Raleigh.
GEOMETRIC VARIATIONAL PRINCIPLES FOR GRAVITATIONAL THEORIES, LANCZOS POTENTIALS, AND A GEOMETRIZATION OF CHARGE CONJUGATION Ph.D. Thesis
William Kenneth Atkins 1980 107 p
Avail: Univ. Microfilms Order No. 8020518

Geometric variational principles of Einstein, Einstein-Cartan, and Sandberg type gravitational theories in terms of a general covering theory are considered. In addition, quadratic variational principles and the variational methods of Lanczos are considered in the context of nonAbelian gauge theories formulated over four dimensional space time. In particular, it is shown that the Lanczos technique of obtaining potentials holds for arbitrary gauge fields formulated over space time. Also, in terms of the Lanczos potentials of Riemann space time (i.e., the so called spin tensor of third order) a gauge-like formulation of the gravitational field, which parallels the Einstein-Maxwell theory, is discussed. Further developments and extensions of the Lanczos results are made in the context of the foundations of classical field theory including a general formal covariant decomposition of Riemannian curvature which formally parallels the Hodge decomposition of p-forms on compact manifolds. A speculative variational principle based on the Lanczos potentials which leads to part of the null region Rainich-Misner-Wheeler already unified field theory conditions is also briefly discussed. Dissert. Abstr.

N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1) Interim Technical Report
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980 489 p refs
(Grant NsG-7479)
(NASA-CR-163671) Avail: NTIS HC A21/MF A01 CSCL 04A

An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere. T.M.

N81-10616*# Illinois Univ., Urbana. Aeronomy Lab.
ION AND ELECTRON TEMPERATURES IN THE TOPSIDE IONOSPHERE
D. E. Munninghoff 1 Apr. 1979 269 p refs
(Grants NSF ATM-75-15523; NSF ATM-77-06787; NSF ATM-78-15224)
(NASA-CR-163670; UILU-ENG-79-2505; Aeronomy-86) Avail: NTIS HC A12/MF A01 CSCL 04A

Experimental and theoretical ion and electron temperatures in the topside ionosphere were investigated. Experimental results came from an analysis of incoherent scatter data taken at Arecibo, Puerto Rico. Consideration of the energy balance equations gave the theoretical ion and electron temperatures. T.M.

N81-10617# Del Mar Technical Associates, Calif.
NEAR-SOURCE PHENOMENA AND THEIR MANIFESTATIONS ON SIGNATURES OF MORE DISTANT RADIATION OF SEISMIC ENERGY Final Report
Randy J. Apsel, Glenn Rawson, Gerald A. Frazier, Jeffrey C. Fried, Joel Sweet, and Peter Glover 30 May 1980 438 p refs
(Contract F49620-79-C-0230; ARPA Order 3368)
(AD-A088832; DELTA-R-79-0042) Avail: NTIS HC A19/MF A01 CSCL 18/3

A systematic analysis of buried explosions was performed for the purpose of determining how near source effects influence seismic observations. Analytical Green's function methods were developed and used to efficiently and accurately extend representations of seismic radiation to the far field domain of interest. Representations of nonlinear process and near source inhomogeneities were provided. The theoretical computational program was conducted in parallel with a review/interpretative program of empirical data from a broad suite of geologic settings. R.C.T.

N81-10618# Naval Research Lab., Washington, D. C.
STRUCTURING OF COLLISIONLESS, HIGH VELOCITY ION CLOUDS
J. A. Fedder 4 Sep. 1980 15 p refs
(AD-A089373; NRL-MR-4307) Avail: NTIS HC A02/MF A01 CSCL 04/1

The stability of high velocity ion clouds was studied in the ionosphere magnetosphere. We derive the instability growth rate; show that the growth is very fast; and present our conclusions. GRA

N81-10619# Naval Research Lab., Washington, D. C.
CONDUCTIVITY FORMULAS FOR THE DISTURBED IONOSPHERE
J. A. Fedder 4 Sep. 1980 15 p refs
(AD-A089374; NRL-MR-4329) Avail: NTIS

HC A02/MF A01 CSCL 04/1

Conductivity formulas are presented for the disturbed ionosphere. These formulas are recommended for use in HANE simulation studies and for other disturbed ionospheric conditions. GRA

N81-10620# Institute for Defense Analyses, Arlington, Va.
A FORMULA FOR COMPARING ANNUAL DAMAGING ULTRAVIOLET DUV RADIATION DOSES AT TROPICAL AND MID-LATITUDE SITES Final Report
Pythagoras Cutchis Jun. 1980 60 p refs
(Contract DOT-FA77WA-3065)
(AD-A089409; IDA-P-1492; FAA-EE-80-21) Avail: NTIS HC A04/MF A01 CSCL 06/18

A simple formula is developed in this paper for the relative annual damaging ultraviolet radiation (DUV) dose at different tropical and mid-latitude sites. The formula consists of six multiplicative factors which include the effects of amount of ozone, latitude, altitude, cloudiness, ground albedo, and amount of aerosols. A seasonal ozone variation factor is introduced to modify the tropical relative DUV formula for application to mid-latitude sites. The approach involves correlations of sometimes sparse data, and remains to be validated in the general sense. The formula should be useful, where more exact data are not available, in studies of the effects of solar ultraviolet radiation, and its possible increase from a reduction in stratospheric ozone on land and marine ecological systems and skin cancer incidence in white Caucasian populations. GRA

N81-10621# Princeton Univ., N. J. Dept. of Statistics.
STATISTICS IN GEOLOGY
Geoffrey S. Watson Jul. 1980 11 p refs
(Contract N00014-79-C-0322)
(AD-A089154; TR-168-SER-2) Avail: NTIS HC A02/MF A01 CSCL 08/7

This article, prepared for the Encyclopedia of Statistical Sciences, gives many references to geological papers according to the statistical methods used. It should be useful to anyone preparing a course for geologists. It may also aid statisticians looking for applications of techniques. GRA

N81-10622# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
INTERNAL WAVE INDUCED MAGNETIC FIELD AND MAGNETIC FIELD GRADIENT SPECTRA AS WOULD BE MEASURED BY AN AIRBORNE MAGNETIC SENSOR Final Report
Wasyl Wasylkiwskyj and Elaine Marcuse May 1980 50 p refs
(Contract MDA-903-79-C-0202)
(AD-A089645; AD-E500206; IDA-P-1465; IDA/HQ-80-22011) Avail: NTIS HC A03/MF A01 CSCL 20/3

Technique is described for computing internal wave induced magnetic field and amgnetic field spectra as these would be measured by airborne magnetic sensors. The intended application is remote sensing of internal wave activity in the upper layers of a deep ocean in the wavelength range less than 1 km. A computer program INTWAVE is presented which is capable of accepting data from towed thermistor chain measurements. Numerical results obtained with INTWAVE are presented for the measured internal wave spectra reported by Nelson and Milder. GRA

N81-10623# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Experimentelle Atmosphaerenphysik 2.
RESULTS ON THE RADIATION BUDGET OF THE TROPICAL ATMOSPHERE FROM MEASUREMENTS MADE ON HEMISPHERICAL RADIANT FLUX DENSITIES IN THE VISIBLE SPECTRAL RANGE DURING THE ATLANTISCHE EXPERIMENT IN 1969
Heinz Queck Oct. 1979 94 p refs In GERMAN; ENGLISH summary
(Contract DFG-MU-85/27)
(DFVLR-FB-79-36) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 16,20

Some sixty-seven radio sondes carried aboard the German vessels, Meteor and Planet, and the American vessel, Discoverer, were employed. Measurements were centered about 550 and 684 nm. Radiant flux densities are given as a function of height for both hemispheres. Frequency distributions are presented together with the different components of the radiation balance (absorption, refection, and transmission). The resulting spectral heating rates are also given. Author (ESA)

N81-10624# Woods Hole Oceanographic Institution, Mass.
THE USE OF COASTAL OCEANS IN THE 80'S: OPPORTUNITIES FOR MARINE GEOLOGY
David A. Ross and David G. Aubrey Apr. 1980 85 p
(Grant NA79AA-D-00102)
(PB80-201858; WHOI-80-19; NOAA-80052713) Avail: NTIS HC A05/MF A01 CSCL 08G

Future uses of the offshore environment and their geological implications are discussed. Nuclear waste disposal; sewage; industrial and dredge material disposal; offshore structures; marine mining; hydrocarbon exploration and extraction; and military related activities are considered. Scientific, economic, engineering, regulatory, environmental and political aspects for each of these uses were discussed and enumerated. Slope stability, catastrophic events, sediment characteristics and shelf morphology and bedforms are included. GRA

N81-10625# National Geodetic Survey, Rockville, Md.
THE BRUNS TRANSFORMATION AND A DUAL SETUP OF GEODETIC OBSERVATIONAL EQUATIONS
Erik W. Grafarend Apr. 1980 79 p refs
(PB80-202302; NOAA-TR-NOS-85; NOAA-80052901) Avail: NTIS HC A04/MF A01 CSCL 08E

The Bruns formula, which equates the disturbing gravity potential modulo the length of the normal gravity vector to the height anomaly, is generalized into three dimensions and into horizontal, equational, and inertial reference frames. It is applied to formulate the spacelike geodetic boundary value problem in geometry and gravity space. The Bruns transform allows a dual setup of geodetic observational equations in a network of mass points, the finite element approximation of the spacelike geodetic boundary value problem, in the following sense: The observational equations can be expressed rigorously either as a function of geometric coordinate corrections alone without any gravity dependent quantity or alone as a function of the gravity disturbing potential and its gradients alone without any geometric coordinate correction. For operational purposes, estimable quantities from reference free observables are studied in geometry, gravity, and vorticity spaces. GRA

N81-10626# Wisconsin Univ. - Madison. Water Resources Center.
DYNAMIC SYSTEM FOR MEASURING SOIL-MOISTURE CHARACTERISTICS AT VARIOUS TEMPERATURES
J. R. Nimmo, E. E. Miller, and W. R. Gardner 1980 41 p refs
(Contracts DI-14-34-0001-7105; DI-14-34-0001-7106; DI-14-34-0001-8053; OWRT Proj. A-072-WIS)
(PB80-204670; W80-06077; WIS-WRC-80-11; OWRT-A-072-WIS(1)) Avail: NTIS HC A03/MF A01 CSCL 08N

Methods were devised for measuring soil moisture characteristics. Sets of values for wetting, drying, and intermediate-reversal (scanning-curve) conditions are presented. Modern technical developments for performing these measurements were utilized. GRA

N81-10627 Washington Univ., St. Louis, Mo.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF OCEAN-EARTH ACOUSTIC COUPLING Ph.D. Thesis
Robert Irving Jr. Odom 1980 175 p
Avail: Univ. Microfilms Order No. 8026285

The details of sound propagation in a liquid wedge with an elastic bottom are investigated. Laboratory experiments show that as sound propagates toward the apex of the wedge, it couples to the bottom in a well defined beam propagating with a large refraction angle in the elastic bottom. The beam width and refraction angle have a weak dependence on the wedge angle. As the wedge angle decreases the beam width decreases and the refraction angle increases. Coupling into the bottom begins well before the cutoff depth of the first mode is reached.

The acoustic energy reflected back out of the wedge was measured and agrees well with numerical calculations indicating the amount of reflected energy is very small for very shallow wedge angles. Two separate numerical models to describe sound propagating in a liquid wedge overlying an elastic solid are developed. One is an acoustic analog to some calculations used to model propagation in a tapered dielectric optical wavelength. The other is a ray theory calculation in which amplitudes are corrected for spreading of the wavefronts due to source geometry and refraction at interfaces. Dissert. Abstr.

N81-10628 Washington Univ., St. Louis, Mo.
FLUCTUATIONS IN GEOPHYSICAL BOUNDARY LAYERS Ph.D. Thesis
George Frederick Spooner, Jr. 1980 225 p
Avail: Univ. Microfilms Order No. 8026314

The initial value problem is solved for a pulse-like disturbance in a laminar Ekman layer. Unstable solutions to the disturbance equations for this flow stem from three different mechanisms of instability and are functions of the horizontal wavenumbers and the Reynolds number. The dependence of the solution to the initial value problem upon these mechanisms is demonstrated by considering cases at three different Reynolds numbers. For short times, a Taylor series expansion is employed to show that the initial change in the disturbance amounts to a flattering and spreading of the pulse. For very long times, an asymptote analysis is employed and the development into series of long crested waves is described. These asymptotic waves have an amplitude proportional to the reciprocal time, and the wavenumbers correspond to those of the fastest growing disturbance mode. Finally, the form of the disturbance is calculated directly for intermediate times by numerical summation of the Fourier series and presented in the form of perspective plots. Dissert. Abstr.

N81-10473*# Arkansas Univ., Fayetteville. Dept. of Geology.
HISTORICAL SKETCH: RADAR GEOLOGY
H. MacDonald *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 23-38 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

N81-10474*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR GEOLOGY: TECHNOLOGY AND PROGRAM OVERVIEW
Frank T. Barath *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 38-41 (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

N81-10476*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EXPRESSION OF SAN ANDREAS FAULT ON SEASAT RADAR IMAGE
Floyd F. Sabins, Jr. (Chevron Oil Field Research Co.), R. Blom, and Charles Elachi *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 64-74 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

N81-10482*# Texas A&M Univ., College Station. Remote Sensing Center.
SOME CONFUSION FACTORS IN RADAR IMAGE INTERPRETATION
Bruce J. Blanchard *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 223-232 (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

N81-10483# Michigan Univ., Ann Arbor.
MULTICHANNEL SAR IN GEOLOGIC INTERPRETATION: AN APPRAISAL
Philip L. Jackson *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 233-250 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

N81-10485*# Alaska Univ., Fairbanks. Geology/Geophysics Program.
APPLICATIONS OF RADAR IMAGERY TO ARCTIC AND SUBARCTIC PROBLEMS
P. Jan Cannon *In* JPL Radar Geol.: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 265-274 ref (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

N81-10492*# Conoco, Inc., Ponca City, Okla. Exploration Research Div.
GEOLOGICAL MAPPING IN THE AMAZON JUNGLE: A CHALLENGE TO SIDE-LOOKING RADAR
Aderbal C. Correa *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 385-416 refs (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

N81-10495*# Phillips Petroleum Co., Bartlesville, Okla.
RADAR, AN OPTIMUM REMOTE-SENSING TOOL FOR DETAILED PLATE TECTONIC ANALYSIS AND ITS APPLICATION TO HYDROCARBON EXPLORATION (AN EXAMPLE IN IRIAN JAYA INDONESIA)
Claude M. Froidevaux *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol: Workshop 1 Sep. 1980 p 457-501 refs Original contains color illustrations (For primary document see N81-10472 01-42)
Avail: NTIS HC A22/MF A01 CSCL 08G

N81-10915# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
AURORAL PARTICLE ACCELERATION: AN EXAMPLE OF A UNIVERSAL PLASMA PROCESS
G. Haerendel *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 9 p refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10916# Centre National de la Recherche Scientifique, Paris (France).
THE FRENCH SOUNDING ROCKET AND BALLOON PROGRAMS [LE PROGRAMME FRANCAIS DE RECHERCHE SPATIALE EN FUSEES-SONDES ET EN BALLONS]
J. P. Chassaing *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 3-6 In FRENCH (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10917# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.
THE GERMAN SCIENTIFIC BALLOON AND SOUNDING ROCKET PROGRAM
A. F. Dahl and M. Otterbein (Bunderministerium fuer Forschung und Technologie, Bonn) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 7-17 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10918# Oslo Univ. (Norway). Inst. of Physics.
THE NORWEGIAN SOUNDING ROCKET PROGRAM, 1980 TO 1983
A. Egeland and A. Gunderson (Royal Norwegian Council for Science and Industrial Research, Oslo) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 19-24 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10919# Uppsala Ionospheric Observatory (Sweden).
THE SWEDISH SOUNDING ROCKET PROGRAM
R. Bostroem *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 25-28 Sponsored by Swedish Board for Space Activities (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10920# Science Research Council, Slough (England).
THE UNITED KINGDOM ROCKET AND BALLOON PROGRAM
J. T. Delury *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 29-31 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10921# Freie Univ., Berlin (West Germany).
TEMPERATURE CHANGES IN THE MESOSPHERE AND STRATOSPHERE CONNECTED WITH CIRCULATION CHANGES IN WINTER
K. Labitzke *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 35-43 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10923# Science Research Council, Slough (England).
MESOSPHERIC TEMPERATURES DEDUCED FROM LASER OBSERVATIONS OF THE NaD2 LINE PROFILE
L. Thomas and S. K. Bhattacharyya *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 49-50 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10924# Science Research Council, Slough (England).
MIDDLE ATMOSPHERE TRACE CONSTITUENTS AS MEASURED BY NIMBUS-7
J. T. Houghton *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 51-54 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10925*# *Liege Univ. (Belgium). Inst. d'Astrophysique.*
A TWO-DIMENSIONAL MODEL OF ODD NITROGEN IN THE THERMOSPHERE AND MESOSPHERE
J. C. Gerard, R. G. Roble (National Center for Atmospheric Research), and D. W. Rusch (Colorado Univ.) In ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 55-60 refs Sponsored in cooperation with Belgian Foundation for Scientific Research (For primary document see N81-10914 01-99)
(Grant LSG-5372)
Avail: NTIS HC A22/MF A01 CSCL 04A

N81-10926# Norwegian Defence Research Establishment, Kjeller.
OBSERVATIONS OF FINE SCALE STRUCTURE IN THE MESOSPHERE AND LOWER THERMOSPHERE
E. V. Thrane and B. Grandal *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 61-65 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10927# Sheffield Univ. (England). Dept. of Physics.
THE SEMI-DIURNAL TIDE IN THE LOWER THERMOSPHERE
T. R. Kaiser, S. P. Kingsley, H. G. Muller, and P. Rutter *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 67-70 refs Sponsored by UK Science Research Council (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10928# Sheffield Univ. (England). Dept. of Physics.
QUASI TWO-DAY OSCILLATIONS IN THE LOWER THERMOSPHERE
H. G. Muller and S. P. Kingsley *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 71-75 refs Sponsored by UK Science Research Council and Meteorological Office (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10932*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for Extraterrestrial Physics.
MIDDLE ATMOSPHERE ELECTRIC FIELDS
N. C. Maynard *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 105-114 refs Sponsored in part by Royal Norwegian Council for Science and Industrial Research (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10933# Bern Univ. (Switzerland). Physikalisches Inst.
POSITIVE ION COMPOSITION IN NOCTILUCENT CLOUDS
E. Kopp, P. Eberhardt, U. Herrmann, and L. Bjoern (Uppsala Ionospheric Observatory, Sweden) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 117-118 refs Submitted for publication (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10951# Bergen Univ. (Norway). Dept. of Physics.
SBARMO-79: EXPERIMENTS AND RESULTS
S. Ullaland, J. Bjordal, L. P. Block (Royal Inst. of Technol., Stockholm), K. Broestad (Oslo Univ., Norway), A. Egeland (Oslo Univ., Norway), J. Holtet, J. Kangas (Oulu Univ., Finland), G. Kremser (Max-Planck Inst. fuer Aeronomie), M. M. Madsen (Danish Space Research Inst., Lyngby), T. Moe et al *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 235-240 Original contains color illustrations Sponsored by Austrian Scientific Research Council, Finnish National. Research Council of Science, NTNF, Swedish Board for Space Activities, Austrian Academy of Science, and Deutsche Forschungsgemeinschaft (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10952# Mullard Space Science Lab., Dorking (England). Dept. of Physics and Astronomy.
WAVE-PARTICLE INTERACTIONS IN THE HIGH ALTITUDE AURORAL IONOSPHERE
A. D. Johnstone *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 243-255 ref (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10953# Kiruna Geophysical Inst. (Sweden).
ELECTRON SPECTRA OVER DISCRETE AURORAS AS MEASURED BY THE SUBSTORM-GEOS ROCKETS
I. Sandahl, L. Eliasson, and R. Lundin *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 257-262 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10954# Kiruna Geophysical Inst. (Sweden).
SOME RESULTS FROM THE AURORAL PARTICLE EXPERIMENT ON BOARD THE BARIUM-GEOS ROCKET
L. Eliasson, R. Lundin, and I. Sandahl *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 263-268 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10955# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
STUDY OF MAGNETOSPHERIC SUBSTORM EVENTS
K. Wilhelm *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 269-277 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10956# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
SOUNDING ROCKET OBSERVATIONS OF FIELD-ALIGNED CURRENT SHEETS
K. Wilhelm, N. Kloecker (Technische Univ., Brunswick), B. Theile (Technische Univ., Brunswick), W. Ott (Fraunhofer Inst. fuer Physikalische Messetechnik, Freiburg), K. Spenner (Fraunhofer Inst. fuer Physikalische Messetechnik, Freiburg), R. Grabowski (Fraunhofer Inst. fuer Physikalische Messetechnik, Freiburg), H. Wolf (Fraunhofer Inst. fuer Physikalische Messetechnik, Freiburg), W. Stuedemann, G. Dehmel (Tech. Univ., Brunswick), H. M. Fischer (Kiel Univ.) et al *In* ESA European Rocket and Balloon Programs and Related Res. (date Jun. 1980 p 279-284 refs Sponsored by Bundesministerium fuer Forschung und Technologie and Austrian Akademie der Wissenschaften (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10957# Science Research Council, Slough (England). Rutherford and Appleton Lab.
THE INFLUENCE OF ENERGY DIFFUSION ON AURORAL PARTICLE DISTRIBUTION
D. S. Hall *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 285-288 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10958# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
OBSERVATION OF AN ENERGETIC PROTON BEAM AND THE GENERATION OF ULF-WAVES ABOVE ACTIVE AURORAL FORMS
W. Stuedemann and C. K. Goertz *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 289-291 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10959# Southampton Univ. (England). Dept. of Physics.
TELEVISION OBSERVATIONS OF THE BARIUM-GEOS ION JET EXPERIMENT
M. A. Hapgood, H. L. Collin, and P. Rothwell *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 293-296 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10963# Southampton Univ. (England). Dept. of Physics.
MAPPING OF AURORAL FORMS FROM AN ALL-SKY COORDINATE GRID
B. S. Lanchester *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 313-315 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10964# Science Research Council, Slough (England). Appleton Lab.
THE 2.2 Hz OSCILLATIONS IN AURORAL ELECTRONS
D. R. Lepine, D. S. Hall, D. A. Bryant, A. D. Johnstone (Mullard Space Science Lab.), P. J. Christiansen (Sussex Univ., England), and M. P. Gough *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 317-321 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10965# Oslo Univ. (Norway).
DAYSIDE CUSP AURORA: CHARACTERISTICS AND PROBLEMS
A. Egeland, K. Henriksen (Tromsoe Univ., Norway), P. E. Sandholt (Tromsoe Univ., Norway), C. S S. Deehr (Alaska Univ., Fairbanks), and G. G. Sivjee (Alaska Univ., Fairbanks) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 323-330 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10966# Sussex Univ., Brighton (England).
BUNCHING OF 8-10 keV AURORAL ELECTRONS AT MHz FREQUENCIES IN THE VICINITY OF AN ARTIFICIAL ELECTRON BEAM
M. P. Gough, G. Martelli, P. N. Smith, B. N. Maehlum (Norwegian Defence Research Establishment, Kjeller), and G. Ventura (Florence Univ.) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 331-336 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10976# Tromsoe University (Norway). Inst. of Mathematical and Physical Sciences.
THE PARTIAL REFLECTION EXPERIMENT (PRE) FACILITY AT RAMFJORDMOEN, TROMSOE, NORWAY
O. Holt, A. Brekke, and T. Hansen *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 387-392 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10979*# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
NATURAL AND ARTIFICIALLY INJECTED ELECTRON FLUXES NEAR DISCRETE AURORAL ARCS
K. Wilhelm *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 407-410 refs Sponsored in cooperation with NASA (For primary document see N81-10914 01-99)
(Grant BMFT-01-OM-046-ZK-A-WRK-274/3)
Avail: NTIS HC A22/MF A01 CSCL 04A

N81-10990# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
THE MIDDLE ATMOSPHERE IONIZED COMPONENT
F. Arnold *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 479-496 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10992# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
THE BARIUM ION JET EXPERIMENTS OF THE PORCUPINE PROJECT
G. Haerendel *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 507-508 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-10629 Washington Univ., Seattle.
MESOSCALE ORGANIZATIONS OF CLOUD PROCESSES IN EXTRATROPICAL CYCLONES Ph.D. Thesis
Thomas John Matejka 1980 377 p
Avail: Univ. Microfilms Order No. 8026267

The configuration of clouds on the mesoscale in extratropical cyclones, the mesoscale organization of the cloud dynamics and microphysical composition, and mesoscale variations in precipitation growth processes are investigated. This is accomplished by the examination of detailed measurements collected with research aircraft, conventional and Doppler radars, rawinsondes, satellites, precipitation gauges, and a network of surface instruments in western Washington. The precipitation in extratropic cyclones is commonly organized in mesoscale rainbands that range from approximately 5 to 100 km in width. It is assumed that the most important variations in the structure of the clouds associated with a mesoscale rainband occur with altitude and with distance perpendicular to the length of the rainband, and the various data are accordingly plotted and analyzed in vertical cross sections that are oriented perpendicular to the rainbands and that move with the rainbands. The data are also stratified by classifying the rainbands according to their positions and orientations relative to the fronts in the cyclone. Rainbands of the same type are found to be associated with similar cloud structures and processes, while the clouds associated with rainbands of different type are often strongly differentiated. Dissert. Abstr.

N81-10630 Virginia Univ., Charlottesville.
SUBCLOUD LAYER ENERGETICS OF PRECIPITATING CONVECTION Ph.D. Thesis
Gary Michael Barnes 1980 225 p
Avail: Univ. Microfilms Order No. 8024061

The thermodynamic modification of the subcloud layer in the GATE area is a function of precipitating convection. A critical rate of 2 mm hr-1, based on the Z-R relationship, distinguishes between evaporation in the subcloud layer (no change in moist static energy, h) and vertical mass transport (decreases in h) into this layer from near and above cloud base. The spatial extent of the active downdrafts is limited to a convective mesoscale area directly under and as much as 15 km downwind of the precipitation causing the change. Mature cells within a mesoscale cloud cluster transport 60 percent more energy per unit mass in the subcloud layer than decaying cells with the same precipitation rate. The initial thermodynamic environment directly affects energy transport per unit mass by moist convection.

Precipitating cells which operate upon an initially undisturbed atmosphere transfer more than twice as much enegy as those clouds which develop in regions with precious precipitation. Downdrafts can act either as a negative feedback mechanism or as generators of new convection. Large, linearly shaped, moving cloud lines are the centers of the most efficient energy transfer. Dissert. Abstr.

N81-10631 Washington Univ., Seattle.
NUMERICAL SIMULATION OF TROPICAL CYCLONE GENESIS Ph.D. Thesis
Vernon LeRoy Bliss 1980 282 p
Avail: Univ. Microfilms Order No. 8026204

Some aspects of tropical cyclone development and the factors that influence it were simulated. The numerical model used simple but adequate physics for ease in interpretation and computational economy. Model characteristics included the following: primitive equations, three layers, incompressible fluid, boundary layer latent and sensible heat exchange with the sea surface, and CISK parameterization as a function of boundary layer convergence and a vertical stability parameter. Because the model had incompressible dynamics, the cumulus convection parameterization simulated the basic effects of cumulus heating as a boundary layer forced mass sink in the lower level and source in upper. Low level vorticity is a much more important intensification criterion than upper level factors. Dissert. Abstr.

N81-10632 Missouri Univ. - Columbia.
ENERGETICS ANALYSIS OF THE ASIATIC WINTER MONSOON Ph.D. Thesis
Paul Ho Chan 1980 149 p
Avail: Univ. Microfilms Order No. 8024345

The large scale kinetic energy budgets in the winter monsoon areas of Siberia, Northeastern Asia, China Main and Japan Sea are studied utilizing aerological data for the winters of 1973-74 and 1975-76. The kinetic energy budget studies for various types of flow patterns in the four regions were discussed. With the exception of Siberia, the kinetic energy generation, outflow and dissipation are associated with the cyclonic type flows. The energy characteristics of the 00 type flow, which is generally a transient state in each region, follow those of the prevalent flow type. Even though the flow patterns over the China Main and Japan Sea areas are predominantly cyclonic, their kinetic energy budgets show extremely intense transformation in comparison with that of an average cyclonic flow over the regions in this study or over North America. The comparison study of the nonoutbreak and outbreak periods shows that the major variations are noted for the China Main and Japan Sea regions with the energy variables being more intense in the outbreak period. Dissert. Abstr.

N81-10633 Wisconsin Univ. - Milwaukee.
THE DYNAMICS OF SEASONAL CHANGE OF THE LONG WAVES AS DEDUCED FROM A LOW-ORDER GENERAL CIRCULATION MODEL Ph.D. Thesis
Bette Lou Otto-Bliesner 1980 247 p
Avail: Univ. Microfilms Order No. 8015224

The dynamics of seasonal change through analysis of long term integrations of a global, low order general circulation model are discussed. The behavior of the long waves, wavenumbers 1 through 4, are investigated in terms of vertically integrated and interharmonic exchanges of energy. The seasonal cycle is explored not only in the northern extratropics where observational data are available for comparison, but also in the tropics and southern extratropics. The temporal variation of the statistics and step function response of the circulation are discussed. Included in the model are: orography; time varying sea surface temperatures, snowcover, and solar declination angle; convection, condensation, diffusion, and surface transport; and, a surface heat budget. A five year seasonal simulation was analyzed. There are indications of asymmetric and steplike responses to the external seasonal forcing in the annual cycles of the energetics. The spring decrease of eddy kinetic energy at northern extratropical latitudes is less rapid than the fall increase. Dissert. Abstr.

N81-10634 Oklahoma Univ., Norman.
A STUDY OF HAIL PRODUCTION IN A SUPERCELL STORM USING A DOPPLER DERIVED WIND FIELD AND A NUMERICAL HAIL GROWTH MODEL Ph.D. Thesis
Stephan Perry Nelson 1980 166 p
Avail: Univ. Microfilms Order No. 8024422

Storm reflectivity and horizontal flow structure are very similar to those reported for previously studied supercell storms. The hail growth model shows millimeter sized embryos that fined their way into the updrafts can originate from several areas. Likely sources are hydrometeors from upper level outflows of both flanking line cells and the main updraft. Typically, any embryo that enters an updraft will experience some growth. Those which achieve greatest growth, however, are the ones which remain balanced in the principal growth zone (6 to 8 km) for the longest time periods. In the numerical model, this critical equilibrium occurs where the horizontal gradient of increased terminal velocity (i.e., mass) nearly balances the positive horizontal gradient of vertical velocity as the hailstones traverse the updraft. The model shows this balance is achieved coincident with the measured reflectivity maximum known previously as the embryo curtain. It appears this area actually demarcates the region of maximum hail growth rather than embryo production and is, therefore, relabeled as the 'hail curtain'. Results of the model have implications for the three seeding techniques of artificial hail suppression--glaciation, competition, and trajectory lowering. Dissert. Abstr.

N81-10635*# Arizona State Univ., Tempe. Coll. of Engineering and Applied Sciences.
EFFECT OF LATERAL SPACING ON WAKE CHARACTERISTICS OF BUILDINGS Final Report
Earl Logan, Jr. and David S. Barber Washington NASA Nov. 1980 75 p refs
(Contract NAS8-32357)
(NASA-CR-3337) Avail: NTIS HC A04/MF A01 CSCL 04B

Measurements relevant to the effect of buildings on the low level atmospheric boundary layer are presented. A wind tunnel experiment was undertaken to determine the nature of the flow downstream from a gap between two transversely aligned, equal sized models of rectangular cross section. These building models were immersed in an equilibrium turbulent boundary layer which was developed on a smooth floor in a zero longitudinal pressure gradient. Measurements of the longitudinal mean velocity and longitudinal turbulence intensity were made using a hot wire anemometer in the plane of symmetry of the wake downstream of the gap. The size of the gap was varied from the case which resembled a single continuous element (no gap) to that which resembled smooth channel flow (very large gap). Quantitative results are presented which show that the three dimensional wake has no recirculation zone and that widening the gap produces a far wake much like the wake behind a two dimensional obstacle of smaller height. T.M.

N81-10636*# FWG Associates, Inc., Tullahoma, Tenn.
PILOT-AIRCRAFT SYSTEM REPONSE TO WIND SHEAR Interim Report
Barry S. Turkel and Walter Frost Washington NASA Nov. 1980 98 p refs
(Contract NAS8-33458)
(NASA-CR-3342) Avail: NTIS HC A05/MF A01 CSCL 04B

The nonlinear aircraft motion and automatic control model is expanded to incorporate the human pilot into simulations of aircraft response to wind to wind shear. The human pilot is described by a constant gains lag filter. Two runs are carried out using pilot transfer functions. Fixed-stick, autopilot, and manned computer simulations are made with an aircraft having characteristics of a small commuter type aircraft flown through longitudinal winds measured by a Doppler radar beamed along the glide slope. Simulations are also made flying an aircraft through sinusoidal head wind and tail wind shears at the phugoid frequency to evaluate the response of manned aircraft in thunderstorm wind environments. S.F.

N81-10637*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FIRST SCIENTIFIC WORKING GROUP MEETING OF AIRBORNE DOPPLER LIDAR WIND VELOCITY MEASUREMENT PROGRAM
John W. Kaufman, ed. Oct. 1980 135 p refs Meeting held in Huntsville, Ala., 25-26 Aug. 1980

(NASA-CP-2161) Avail: NTIS HC A07/MF A01 CSCL 04B

The purpose of the first scientific working group meeting was fourfold: (1) to identify flight test options for engineering verification of the MSFC Doppler Lidar; (2) to identify flight test options for gathering data for scientific/technology applications; (3) to identify additional support equipment needed on the CV 990 aircraft for the flight tests; and (4) to identify postflight data processing and data sets requirements. The working group identified approximately ten flight options for gathering data on atmospheric dynamics processes, including turbulence, valley breezes, and thunderstorm cloud anvil and cold air outflow dynamics. These test options will be used as a basis for planning the fiscal year 1981 tests of the Doppler Lidar system. For individual titles, see N81-10638 through N81-10645.

N81-10638*# M&S Computing, Inc., Huntsville, Ala.
SEVERE STORMS MEASUREMENT SYSTEM REAL TIME DATA PROCESSING AND DISPLAYS
Harold B. Jeffreys *In* NASA. Marshall Space Flight Center First Sci. Working Group Meeting of Airborne Doppler Lidar Wind Velocity Meas. Program Oct. 1980 15 p (For primary document see N81-10637 01-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

The objectives of the system are to provide the system operator with real time system performance check and to provide data recording of all SSMS data. Meteorologists are provided with real time indication of meteorological data measurements including aid for directing flight profiles in real time and aid for directing SSMS operations. A day-to-day feedback is provided to meteorologists, system operators, and flight crews for flight planning on subsequent flight tests days. E.D.K.

N81-10639*# Lassen Research, Manton, Calif.
FIRST SCIENTIFIC WORKING GROUP MEETING OF AIRBORNE DOPPLER LIDAR WIND VELOCITY MEASUREMENT PROGRAM, APPENDIX C
Robert W. Lee *In* NASA. Marshall Space Flight Center First Sci. Working Group Meeting of Airborne Doppler Lidar Wind Velocity Meas. Program Oct. 1980 8 p (For primary document see N81-10637 01-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

The problem is to operate on two scalar fields to produce a vector field, to produce user products from the vector field, and to establish reliability of results. Data problems encountered include sparse measurements, irregular distribution, varying quality, imperfect orthogonality, aliasing due to sampling volume, and measurements not simultaneous. Desired algorithm characteristics, solution elements, and characteristics of the model are listed. The seven simulation elements, eight algorithm steps and the required user inputs are given. E.D.K.

N81-10640*# Lassen Research, Manton, Calif.
WINDFIELD RETRIEVAL FROM DOPPLER LIDAR OBSERVATIONS
Robert W. Lee *In* NASA. Marshall Space Flight Center First Sci. Working Group Meeting of Airborne Doppler Lidar Wind Velocity Meas. Program Oct. 1980 20 p (For primary document see N81-10637 01-47)
(Contract NAS8-33389)
(ITR-1) Avail: NTIS HC A07/MF A01 CSCL 04B

An approach to the retrieval of a vector wind field from Doppler lidar observations is developed in general terms. The field of radial velocity measurements from each look angle is modeled by a smooth surface, the parameters of the model being determined from the data by least squares techniques. The vector wind field and higher order fields are obtained from the two modeled surfaces. Estimated measurement errors are taken into account, and error estimates are available for all output data sets. Author

N81-10641*# National Center for Atmospheric Research, Boulder, Colo.
COOPERATIVE CONVECTIVE PRECIPITATION EXPERIMENT
Lavon J. Miller *In* NASA. Marshall Space Flight Center First Sci. Working Group Meeting of Airborne Doppler Lidar Wind Velocity Meas. Program Oct. 1980 25 p (For primary document see N81-10637 01-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

The experiment strives to improve understanding of the physics of convective precipitation. Major emphasis is placed on obtaining a good description of the whole convective precipitation system. A framework is presented within which single, significant, tractable problems are investigated. E.D.K.

N81-10642*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REPORT OF CONVECTIVE PHENOMENA TEAM
H. Orville, R. Koenig, J. Miller, J. Telford, B. Jones, G. Alger, R. Lee, and D. Boudle *In its* First Sci. Working Group Meeting of Airborne Doppler Lidar Wind Velocity Meas. Program Oct. 1980 10 p (For primary document see N81-10637 01-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

A group meeting was assembled to focus on the planning of specific experiments, to establish some priorities, identify interested scientists who would like to participate, establish any special requirements, make recommendations on data processing, and to prepare flight plan outlines. Since the number of convective storms in the CCOPE (Cooperative Convective Precipitation Experiment) field experiment area are limited to only a few days during the operational time period the flight plans must be designed with a hierarchy of abort experiments so that the easily identified and lowest probability events should take priority until their quota is filled. E.D.K.

N81-10643*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REPORT OF SECONDARY FLOWS, BOUNDARY LAYERS, TURBULENCE AND WAVE TEAM, REPORT 1
J. Scoggins, D. Fitzjarrald, R. Doviak (National Severe Storms Lab.), and W. Cliff *In its* First Sci. Working Group Meeting of Airborne Doppler Lidar Wind Velocity Meas. Program Oct. 1980 8 p (For primary document see N81-10637 01-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

General criteria for a flight test option are that: (1) there be a good opportunity for comparison with other measurement techniques; (2) the flow to be measured is of considerable scientific or practical interest; and (3) the airborne laser Doppler system is well suited to measure the required quantities. The requirement for comparison, i.e., ground truth, is particularly important because this is the first year of operation for the system. It is necessary to demonstrate that the system does actually measure the winds and compare the results with other methods to provide a check on the system error analysis. The uniqueness of the laser Doppler system precludes any direct comparison, but point measurements from tower mounted wind sensors and two dimensional fields obtained from radars with substantially different sampling volumes are quite useful. E.D.K.

N81-10644*# National Severe Storms Lab., Norman, Okla.
REPORT OF SECONDARY FLOWS, BOUNDARY LAYERS, TURBULENCE AND WAVE TEAM
Richard Doviak *In* NASA. Marshall Space Flight Center First Sci. Working Group Meeting of Airborne Doppler Lidar Wind Velocity Meas. Program Oct. 1980 11 p refs (For primary document see N81-10637 01-47)
(Rept-2) Avail: NTIS HC A07/MF A01 CSCL 04B

Correspondence concerning the comparison of horizontal wind fields, two dimensional spectra, heat flux, mesoscale divergence and deformation in the prestorm environment, and thunderstorm gust front winds is presented. Other subjects include the use of radar to determine heating rate and evaporation near the Earth's surface for an unstable boundary layer and statistical considerations in the estimation of wind fields from single Doppler radar and application to prestorm boundary layer observations. E.D.K.

N81-10645*# National Science Foundation, Washington, D. C.
FIRST SCIENTIFIC WORKING GROUP MEETING OF AIRBORNE DOPPLER LIDAR WIND VELOCITY MEASUREMENT PROGRAM, APPENDIX J
L. Randall Koenig *In* NASA. Marshall Space Flight Center First Sci. Working Group Meeting of Airborne Doppler Lidar Wind Velocity Meas. Program Oct. 1980 5 p (For primary document see N81-10637 01-47)
Avail: NTIS HC A07/MF A01 CSCL 04B

Three projects are suggested which could be done using the Doppler lidar. The first is a cooperative effort at BAO, the purpose of which is to check out instrumentation and contribute to boundary layer investigations at BAO. The second concerns unintended weather modification. Its purpose is to detect mechanisms by which regions of industry and urbanization modify weather. The cirrus cloud study proposes to characterize cirrus clouds by their lidar signal and to compare lidar and visually observed characteristics. E.D.K.

N81-10646# Federal Aviation Agency, Atlantic City, N.J. Technical Center.

EVALUATION OF THE TRANSCRIBED WEATHER BROADCAST (TWEB) SYSTEM AND ALTERNATIVES. VOLUME 1: TECHNICAL AND OPERATIONAL ASSESSMENT AND COST SUMMARY Final Report, Mar. 1978 - Aug. 1979

Floyd B. Woodson, Richard H. Rood, and John D. Barab Aug. 1980 91 p refs

(FAA Proj. 131-401-840)

(AD-A089054; FAA-CT-80-6-1; FAA-RD-80-63-1) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report contains findings related to the evaluation of the Transcribed Weather Broadcast (TWEB) System in its current national configuration. Primary emphasis is keyed to the technical and operational performance of TWEB at selected representative field locations. In addition, discussions concerning the review and appraisal of TWEB and Pilots Automatic Telephone Weather Answering Service (PATWAS) documentations and system design aspects of the overall TWEB configuration are given. A summary of cost analyses for TWEB and mass weather dissemination services accessed by telephone are included in this report. Details of these analyses are included in a second volume. Finally, the report provides a set of conclusions and recommendations that may be acted upon at low cost to improve short-term operational effectiveness, regardless of long-range systematic decisions. No large facilities and equipment (F E) expenditures are recommended until completion of an overall TWEB system design. It is also recommended that near-term programming should include funding to carry out investigatory work in exploring concepts for modernizing the TWEB system through redesign. GRA

N81-10647# World Meteorological Organization, Geneva (Switzerland).

THE ROLE OF AGROMETEOROLOGY IN AGRICULTURAL DEVELOPMENT AND INVESTMENT PROJECTS

1980 96 p refs

(WMO-536; TN-168; ISBN-92-63-10536-7) Avail: NTIS HC A05/MF A01

General information is given on the importance, the availability and the general use of meteorological data services and information. The discussion covers livestock and forestry as well as field and plantation crops under both irrigated and nonirrigated conditions. The components of agrometeorological information are identified, with emphasis on the correct interpretation of climate data. Sources of agrometeorological information are given. Author (ESA)

N81-10648# Research Inst. of National Defence, Linkoeping (Sweden).

INVESTIGATIONS OF THE METEOROLOGICAL INFLUENCE ON AEROSOL TRANSMISSION IN THE 0.5 - 14 MICROMETER WAVELENGTH RANGE

Arne Haagaard, Bertil Nilsson, and Hans Ottersten Apr. 1980 26 p refs Presented at IFAORS Workshop on Atmospheric Aerosols: Their Formation, Optical Properties and Effects, Baltimore, 6-8 Nov. 1979

(FOA-C-301-82-E1-E3) Avail: NTIS HC A03/MF A01

In a theoretical model, based on Mie theory, the aerosol extinction is derived from particle size distribution and refractive index. A profound weather influence on the wavelength dependence of the aerosol extinction was evident from the model. Verification and modification of the model was based on transmission measurements along a horizontal path. Every 10 min for 15 months of automatic operation the transmissometer provided extinction values in 15 bands in the 0.5 - 14 micrometer wavelength interval, along with surface data from meteorological sensors. After subtraction of the water vapor extinction, calculated from surface data with the Lowtran program, the aerosol extinction was obtained. Author (ESA)

N81-10649# World Meteorological Organization, Geneva (Switzerland).

MANUAL ON THE GLOBAL OBSERVING SYSTEM. VOLUME 1: ANNEX 5 TO THE WMO TECHNICAL REGULATIONS - GLOBAL ASPECTS

1980 82 p refs

(WMO-544-Vol-1; ISBN-92-63-10544-8) Avail: NTIS HC A05/MF A01

Regulatory material for the global and regional aspects of the system is presented. The regulations stem from recommendations of the commission for basic systems and resolutions of regional associations, as well as from decisions taken by Congress and the executive committes. The main chapters are: organization of the Global Observing System; requirements for observational data; surface based subsystem, space-based subsystem, reduction of level one data, quality control, and monitoring of the World Weather Watch. Author (ESA)

N81-10650# World Meteorological Organization, Geneva (Switzerland).

[ACTIVITIES OF THE WORLD METEOROLOGICAL ORGANIZATION FOR 1979] Annual Report

1980 226 p refs

(WMO-552; ISBN-92-63-10552-9) Avail: NTIS HC A11/MF A01

Activities in the following six program areas are described: World Weather Watch; the research and development; meteorological applications and environment; hydrology and water resources development; technical cooperation; and education and training. Other technical and supporting activities are outlined, including administrative and legal matters. Author (ESA)

N81-10651# National Weather Service, West Columbia, S. C. Emergency Preparedness Div.

SOUTH CAROLINA TORNADOES, 1977 - 1979

John C. Purvis, ed. South Carolina Office of the Adjustment General 1980 32 p

(PB80-200041) Avail: NTIS HC A03/MF A01 CSCL 04B

An average of about ten tornadoes occur each year in South Carolina. During the interval 1956 through 1979, 230 tornadoes were reported in the Palmetto state. Tornadoes occur every month in South Carolina but are most frequent in spring and least frequent in winter. The months of April and May account for one third of the total and about 70 percent come in the months of March, April, May and June. The outer coasts plain tends to have another maximum in August and September. Many of these are waterspouts or tornadoes which accompany tropical storms or hurricanes. A tabulation of tornadoes in South Carolina during the period 1977 to 1979 is presented giving the date, county and a description of the tornado. GRA

N81-10652# National Weather Service, Washington, D.C. Climate Analysis Center.

PROCEEDINGS OF THE 4TH ANNUAL CLIMATE DIAGNOSTICS WORKSHOP

Jay S. Winston, ed. Mar. 1980 450 p refs Workshop held at Madison, Wisconsin, 16-18 Oct. 1979

(PB80-201130; NOAA-S/T-80-150; NOAA-80060201) Avail: NTIS HC A19/MF A01 CSCL 04B

The Workshop concentrated principally on reports of a variety of climate diagnostic studies of the observed atmosphere and of model atmospheres. Also emphasized were the Climate Analysis Center (CAC) program and the selection of indices and analyzed fields for inclusion in a real time diagnostics data base at CAC. Some of the opportunities as well as the problems involved in using the National Meteorological Center and National Environmental Satellite Service data bases for climate analysis were treated. A special topic for this year, volcanic activity and climate was addressed. GRA

N81-10653# National Oceanic and Atmospheric Administration, Washington, D. C.

NATIONAL HURRICANE OPERATIONS PLAN

May 1980 68 p Presented at 34th Ann. Conf., Homestead

AFB, Fla., 22-25 Jan. 1980; sponsored by Subcom. on Basic Services, Interdepartmental Comm. for Meteorol. Services and Supporting Res.
(PB80-204027; FCM-80-2; NOAA-80052908) Avail: NTIS HC A04/MF A01

The Hurricane Warning Service is an interdepartmental effort to provide the nation and designated international recipents with environmental data, forecasts, and assessments concerning tropical and subtropical weather systems. Interdepartmental cooperation achieves economy and efficiency in the operation of the Hurricane Warning Service. This plan provides the basis for implementing the agreements of the Department of Commerce, Department of Defense and the Department of Transportation reached at the annual interdepartment Hurricane Warning Conference (combined Atlantic and Pacific). GRA

N81-10654# Atmospheric Research and Technology, Inc., Sacramento, Calif.
WIND RESOURCE ASSESSMENT IN CALIFORNIA Final Report
Edwin X. Berry May 1980 77 p refs
(PB80-195167; CAEC-51; CAEC-500-80-024) Avail: NTIS HC A05/MF A01 CSCL 10A

A strategy for wind energy prospecting, a design for a wind prospecting instrument, and a method of analysis of wind energy data are provided. The formulation also produces an improved basis for the calculation of wind machine performance using only a few wind parameter measurements. GRA

N81-10655# Texas A&M Univ., College Station.
INVESTIGATIONS OF THE RADAR-ECHO CLIMATOLOGY OF SOUTHERN HIPLEX Final Report
Dennis M. Driscoll Jan. 1980 143 p refs Prepared in cooperation with Texas Dept. of Water Resources, Austin
(Contract DI-14-06-D-7587)
(PB80-200587; LP-121) Avail: NTIS HC A07/MF A01 CSCL 04B

Climatological characteristics of radar echoes in the Southern HIPLEX area are documented and reports on the synoptic climatology of the region are presented. A connection for radar bias from PP1 films from the Amarillo and Midland National Weather Service WSR-57 radars (10 cm) is developed. The effects of seeding on convective cell characteristics as deduced from radar echoes on a smaller scale than was previously possible are analyzed. GRA

N81-10656# Texas Technological Univ., Lubbock. Atmospheric Science Group.
DETERMINATION OF CLOUD AND PRECIPITATION CHARACTERISTICS FROM SATELLITE, RADAR AND RAINGAGE ANALYSIS Final Report, 1 Jan. - 31 Dec. 1979
Donald R. Haragan, Jerry Jurica, and Colleen A. Leary 1 Jan. 1980 79 p refs Sponsored in part by Dept. of Interior and Texas Dept. of Water Resources
(PB80-200470; LP-127) Avail: NTIS HC A05/MF A01 CSCL 04B

Data gathered during the Texas HIPLEX field programs of 1977, 1978 and 1979 are analyzed and discussed. Specific data treated are recording raingage data, digitized radar data and geostationary satellite radiance data. Individual analyses are presented as well as results derived from integration of the several data sources into a more complete case study of certain dates. It is concluded that such integration of individual analyses yields greatly improved understanding of the relevant meteorological processes. GRA

N81-10657# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
OPTICAL SYSTEM MODEL 4 FOR SPACE-AVERAGED WIND AND (C SUB n)2 MEASUREMENTS
G. R. Ochs and W. D. Cartwright Mar. 1980 37 p refs
(Contract NOAA-ASL-79-8026)
(PB80-208101; NOAA-TM-ERL-WPL-52; NOAA-80061116) Avail: NTIS HC A03/MF A01 CSCL 04B

An optical instrument that measures the path averaged values of the refractive index structure parameter (sq C sub n) and the crosswind over optical paths from 200 to 1500 m. Optimum path lengths of 900 to 1200 m, sq C sub n can be measured over a range for 1 x 10 to the minus 12 power to 1 x 10 to the minus 16 power/m to the 2/3rd power. GRA

N81-10658# Texas Dept. of Water Resources, Austin. Dept. of Meteorology.
PRELIMINARY CLOUD MICROPHYSICS STUDIES FOR TEXAS HIPLEX, 1979
Alexis B. Long Mar. 1980 84 p refs Sponsored in part by Water and Power Resources Service
(Contract DI-14-06-D-7587)
(PB80-200603; LP-124) Avail: NTIS HC A05/MF A01 CSCL 04B

Cloud microphysics studies made in connection with Texas HIPLEX 1979 are described. Important natural precipitation mechanisms in summertime convective clouds in the Big Spring, Texas area are reported. GRA

N81-10930# University Coll., London (England). Dept. of Physics and Astronomy.
ASYMMETRIC GLOBAL CIRCULATION SYSTEMS FOLLOWING GEOMAGNETIC SUBSTORMS
D. Rees, T. J. Fuller-Rowel, and P. A. Rounce *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 81-88 refs (For primary document see N81-10914 01-99) Avail: NTIS HC A22/MF A01

N81-10931# University Coll., London (England). Dept. of Physics and Astronomy.
MIDDLE ATMOSPHERE WINDS FROM A BALLOON-BORNE FABRY-PEROT INTERFEROMETER
D. Rees, P. A. Rounce, and I. McWhirter *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 89-101 refs (For primary document see N81-10914 01-99) Avail: NTIS HC A22/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-10659# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
A FIELD STUDY OF THE PHYSICAL PROPERTIES, RESPONSE TO SWELL, AND SUBSEQUENT FRACTURE OF A SINGLE ICE FLOE IN THE WINTER BERING SEA
Vernon A. Squire and Seelye Martin Jul. 1980 62 p refs
(Contracts N00014-76-C-0234; N00014-78-G-0003; NR Proj. 307-252)
(AD-A087940; SR-18) Avail: NTIS HC A04/MF A01 CSCL 08/12

Surface strain and vertical heave response experiments were conducted for a single floe within the marginal ice zone of the winter Bering Sea. The strain was measured using an array of three strainmeters placed in a 120 deg rosette configuration, and the heave was computed from simultaneous records of vertical acceleration on the floe and in the water around the floe. Physical properties studies and underwater traverses by divers were also carried out for the floe. The data are presented and interpreted in the light of the subsequent floe fracture; the mean fracture strain amplitude epsilon is found to lie between 44 and 85 micro-strain. A discussion of the directionality of the wave energy during the experiment is also given. GRA

N81-10660# Woods Hole Oceanographic Institution, Mass. Dept. of Physical Oceanography.
WINTERTIME CONVECTION AND FRONTAL INTERLEAVING IN THE SOUTHERN OCEAN Ph.D. Thesis
John Merrill Toole Jun. 1980 330 p refs
(Grants NSF OCE-75-14056; NSF OCE-76-82036; NSF OCE-77-28355)
(PB80-197601; WHOI-80-25) Avail: NTIS HC A15/MF A01 CSCL 08C

The air-sea interactions and structure of the near surface waters of the Southern Ocean are investigated with a three dimensional numerical model which resolves the annual sea ice oscillation. The characteristics of the surface mixed layer, the

temperature minimum layer, and the distribution of winter time sea ice are reproduced well by this model. The model results and direct calculations of air sea exchanges suggest a southward heat flux. The lateral water mass transition across the front occurs over a finite sized zone of fluid which is dominated by intrusive finestructure. GRA

N81-10661# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
ON SURFACE GRAVITY WAVE SPECTRA OBSERVED IN A MOVING FRAME OF REFERENCE
Robert Bryan Long Jun. 1979 40 p refs
(PB80-204050; NOAA-TM-ERL-AOML-38; NOAA-80052903)
Avail: NTIS HC A03/MF A01 CSCL 08B

Spectral analyses of one or two dimensional records of sea surface elevation yield one or two dimensional encounter spectra that are, in fact, weighted integrals over the two dimensional surface wave spectrum. These integral relationships are determined by the type of record and the motion of the observer relative to the water on which the waves are running. The relevant relationships are derived for uniform translation of the observer at arbitrary velocity and for arrays of discrete or linearly distributed sensors. The problem of estimating the wave spectrum, given the encounter spectrum, is considered in detail for the two cases exemplified by a wave gage array in a current and by a side looking surface imaging radar. GRA

N81-10662 Washington Univ., St. Louis, Mo.
FORCED INTERNAL WAVES IN THE ARCTIC OCEAN Ph.D. Thesis
James Howe Morison 1980 303 p
Avail: Univ. Microfilms Order No. 8026278

When the surface of an ocean is disturbed by the effects of a storm, motions may be excited in the pycnocline by the action of forced internal waves. Experimental and theoretical studies of such motions are presented. Theories are developed which deal with the forcing of internal waves by surface stress, atmospheric pressure, and buoyancy flux. Solutions are derived for the forced motions as sums of internal wave normal modes. Arbitrary stratification is allowed below the surface mixed layer and the kinematic surface boundary condition is used. The solution for forcing by surface stress is unique in that it combines the use of arbitrary stratification with a body force approximation for surface stress. Two different integral expressions are derived for the response and give identical results. The response to surface pressure is determined using normal mode decomposition.
Dissert. Abstr.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-10663 Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 14, NO. 5, 1980
30 Oct. 1980 149 p refs Transl. into ENGLISH of Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep.-Oct. 1980 (JPRS-76727) Copyright. Avail: NTIS HC A07

Space flight stress and astronaut performance are discussed. Topics include astronaut selection, weightlessness effects, orthostatic tolerance, life support systems, and nutritional and exercise requirements. For individual titles, see N81-10664 through N81-10685.

N81-10664 Joint Publications Research Service, Arlington, Va.
FLUID-ELECTROLYTE HOMEOSTASIS AND WEIGHTLESSNESS **c52**
O. G. Gazenko, A. I. Grigoryev, and Yu. V. Natochin *In its* USSR Rept: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 1-11 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 3-10 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

Stable volume, osmotic concentration, and ionic composition of internal fluids are a mandatory prerequisite for persons to be in a good condition and highly efficient. Physiological systems regulate the concentration of each electrolyte in blood and other endogenous fluids, the balance between intake and output, and total salt content of the body. The purpose of this survey is to discuss the causes, mechanisms, and significance of disturbances in electrolyte metabolism, to determine whether they are primary or secondary, as well as to determine the systems changes which caused these disturbances. This is of basic importance to development of preventive methods and comprehension of the mechanisms of action of weightlessness on the human body.
E.D.K.

N81-10665 Joint Publications Research Service, Arlington, Va.
PROBLEMS AND PROSPECTS OF SPACE PHARMACOLOGY **c52**
V. S. Shaskov and V. V. Sabayev *In its* USSR Rept: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 12-28 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 10-20 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

The Soviet and foreign literature on the pharmacological support of manned space flights is reviewed with emphasis on pharmacological prophylaxis and therapy of adverse effects of the space environment. The future development of pharmacological studies as part of space medicine is discussed. E.D.K.

N81-10666 Joint Publications Research Service, Arlington, Va.
BIORHYTHMOLOGICAL STATUS AS ONE OF THE CRITERIA FOR COSMONAUT SCREENING **c52**
S. I. Stepanova *In its* USSR Rept: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 29-34 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 20-24 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

The concept of biorhythmological status of the human body is discussed in two aspects, constancy and variability of circadian rhythms of vital functions. The relationship between the two parameters is described in the light of a hierarchic structure of the circadian system. The dependence of stress resistance upon integrity and level of organization of the circadian system is ascertained. The importance of assessment of biorhythmological status for proper cosmonaut selection is emphasized. E.D.K.

N81-10667 Joint Publications Research Service, Arlington, Va.
STUDY OF THE COMBINED EFFECT OF ANTIORTHOSTATIC POSITION AND LBNP ON MAN'S TRACKING ACCURACY AND SPATIAL ORIENTATION **c52**
B. B. Bokhov, B. B. Yegorov, A. A. Savilov, and Yu. N. Taranenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 35-45 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 25-28 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

Test subjects exposed to a head down tilt at -30 deg for an hour participated in the experiment. The use of lower body negative pressure (LBNP) during tilting improved precision of arrow orientation on the round shaped screen (during continuous tracking) but did not influence orientation relative to the gravitational axis and the long axis of the body. The selective effect of LBNP on the orientation can be attributed to the increased importance of inner coordinates due to the pressure of interior walls of the LBNP suit on the foot surface and blood pooling in the dependent part of the body. E.D.K.

N81-10668 Joint Publications Research Service, Arlington, Va.
CIRCULATORY REACTIONS OF FIRST CREW OF THE SALYUT-6 ORBITAL TEST WITH LBNP
V. A. Degtyarev, L. Ya. Andriyako, V. M. Mikhaylov, V. N. Ragozin, Zh. G. Adamchik, I. V. Alferova, V. A. Andretsov, and A. N. Kozlov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 41-45 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 29-32 (For primary document see N81-10663 01-52)
Avail: NTIS HC A07

During the first two weeks of space flight the crew members showed circulation reactions to LBNP that were typical of reduced orthostatic tolerance. At later flight stages (beginning with mission day 49) the Commander displayed a gradual recovery of the cardiovascular function. The Flight Engineer exhibited reactions indicating his decreased tolerance of LBNP tests. E.D.K.

N81-10669 Joint Publications Research Service, Arlington, Va.
DYNAMICS OF DIASTOLIC PHASE STRUCTURE DURING A 140 DAY SPACE FLIGHT **c52**
I. V. Alferova, A. D. Yegorov, and A. P. Polyakova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 46-50 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 32-35 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

The phasic structure of the diastole was examined by the kinetocardiographic (KKG) method. Mechanical signals were converted by means of a piezoceramic sensor, the receiving part of which, in the form of rubber capsules (4x6 cm in size) filled with porolon (plastic), was placed in the region of the apex beat and fourth intercostal space on the right, on the parasternal line. The KKG was recorded on polynome-2M equipment at relative rest, and the data were transmitted to earth via telemetry channels. The studies were conducted 4 times before the flight, 16 times during the flight and twice in the postflight period. The following systolic parameters were measured: the phases of isomeric relaxation; the rapid and slow filling; and the atrial systole. Significant results are reported. R.C.T.

N81-10670 Joint Publications Research Service, Arlington, Va.
RESULTS OF INFLIGHT ELECTROCARDIOGRAPHIC STUDIES OF SALYUT-5 CREW **c52**
V. A. Degtyarev, V. S. Bednenko, V. K. Gabyshev, V. A. Sapozhnikov, and V. P. Sidorov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Nov. 1980 p 51-55 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 35-38 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

In Salyut-5 crewmembers, electrocardiograms were recorded in 12 standard and D-S leads. No marked changes in bioelectric properties of the myocardium were detected. During the second part of the mission changes in the terminal portion of the ventricular complex in the left sternal leads were observed. It is presumed that they were induced by repolarization anomalies due to neurohormonal effects on myocardial metabolism. Members of the second crew did not exhibit similar electrocardiographic changes. R.C.T.

N81-10671 Joint Publications Research Service, Arlington, Va.
FUNCTIONAL ASYMMETRY OF OPERATOR PERFORMANCE **c53**
A. G. Fedoruk and T. A. Dobrokhotova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 56-62 refs Transl. into ENGLISH Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, No. 5, Sept. - Oct. 1980 p 39-42 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

The relationship between the level of operator's activity and functional asymmetry of hands, feet, eyes and ears was established. It is shown that the level of the operator's activity is increased due to a well expressed right-handed asymmetry of hands, eyes and ears with feet asymmetry being of less importance. R.C.T.

N81-10672 Joint Publications Research Service, Arlington, Va.
EFFECT OF SOME FACTORS THAT SIMULATE SPACE FLIGHTS ON BLOOD PLASMA LEVELS OF FREE AND PROTEIN-BOUND 11-HYDROXYCORTICOSTEROIDS **c52**
S. S. Kalandarov, V. P. Bychkov, A. S. Ushakov, and G. I. Proskurova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 63-69 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 43-47 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

Effect of space flight simulation factors (ascent to an altitude of 8,000 m, anticipation of centrifugation, psychological test, hypokinesia, and enclosure in an altitude chamber) on the content of free protein-bound 11-hydroxycorticosteroids in plasma was studied. This exposure produced changes in the total and fractional content of the hormones. The change depended on the simulation factor, duration of its action, and functional status of test subjects. Author

N81-10673 Joint Publications Research Service, Arlington, Va.
RENAL FUNCTION AND GLUCOCORTICOID ACTIVITY OF THE ADRENAL CORTEX DURING IMMERSION **c52**
I. S. Balakhovskiy and V. B. Noskov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 70-74 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 47-50 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

Renal and adrenal function was studied in six normal men during and after 3 day water immersion used as weightlessness simulation. The renal excretion of fluid, basic electrolytes, creatinine and total 17-hydroxycorticosteroids (17-HOCS) for 24 hours and following a provocative water-load test (20 ml/kg) was measured. During the first post-immersion day diuresis increased by 77%, excretion of sodium by 42%, 17-HOCS by 43% and creatinine by 34% as compared to the pre-immersion level. Potassium excretion remained essentially unchanged. The circadian rhythm of excretion of the above substances was normal: at night the excretion decreased and in the morning increased noticeably. Renal function and adrenal activity was carried out 56 hours after the begining of water immersion, using a provocative water-load test. Water excretory and osmoregulatory functions of kidneys, and glucocorticoid activity of adrenals remined normal. These data give evidence that during a 60 hour exposure to water immersion no functional hypocorticism develops. R.C.T.

N81-10674 Joint Publications Research Service, Arlington, Va.
ERYTHROCYTE BALANCE DURING 182-DAY HYPOKINESIA **c52**
T. Ye. Burkovskaya, A. V. Ilyukhin, V. I. Lobachik, and V. V. Zhidkov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 75-80 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 50-54 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

A prolonged head-down tilt resulted by the end of the second month in a significant decrease in the circulating blood volume at the expense of plasma and erythrocyte volumes. One of the factors that caused a reduction in the erythrocyte volume was their survival time shortening. The fact that during the rest four hypokinetic months there was no further decline in the erythrocyte count was attributed to adaptive developments: increase of bone marrow production and rate of differentiation of erythroid elements. Exercises used as a countermeasure could slightly conteract the adverse effects of head-down tilt. Author

N81-10675 Joint Publications Research Service, Arlington, Va.
EFFECT OF PROLONGED ANTIORTHOSTATIC POSITION ON CARDIAC BIOELECTRICAL ACTIVITY ACCORDING TO EKG TRACINGS FROM CORRECTED ORTHOGONAL LEADS **c52**
V. D. Turbasov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 81-87 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 54-59 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

The effect of the time of head-down tilting on electrocardiographic parameters was consistent and significant ($P < 0.05$): a slight increase in heart rate in groups 1 and 3, an increased time of atrioventricular conductance, an increased amplitude of the QRS complex, and a decreased amplitude of T wave, primarily in groups 1 and 3. No dystrophic signs were detected. The high level of heart rate in group 3 during the recovery period suggests a more pronounced decline of functional capabilities of

the heart. There are grounds to believe that countermeasures produce a relatively greater effect on the function of the myocardium than on its metabolism. Author

N81-10676 Joint Publications Research Service, Arlington, Va.
VESTIBULAR NYSTAGMUS IN RATS AFTER HYPOKINESIA AND PROLONGED ROTATION
V. G. Vechkin and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 88-93 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 59-63 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

Changes in the latent period, number of beats, duration and frequency of the nystagmus were investigated in rats exposed to angular acceleration of an increasing value (10, 20, 30, and 40 degree/sq cm) after a 21 day exposure to hypokinesia per se or hypokinesia in a rotating device (with a radius of 141 cm, rate of rotation of 33.3 rpm, and acceleration value of 2 g). The hypokinetic rats showed nystagmic changes only with the lowest acceleration used (10 deg/sq cm). The hypokinetic animals rapidly adapted to a repeated exposure to angular acceleration during the recovery period. A 21 day exposure to hypokinesia in a rotating device disturbed adaptation to a repeated effect of angular acceleration during recovery. Mechanisms of these effects are discussed. It is concluded that hypokinesia cannot be an adequate model for studying weightlessness effects on the vestibular function. Author

N81-10677 Joint Publications Research Service, Arlington, Va.
EFFECT OF EXERCISE, VITAMIN AND MINERAL SUPPLEMENTS ON REPRODUCTIVE FUNCTION OF ALBINO RATS DURING PROLONGED HYPOKINESIA
Ye. A. Stroganova, Yu. F. Udalov, V. I. But, V. Ye. Potkin, and I. V. Rogacheva *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 94-98 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 63-65 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

The reproductive function of white rats exposed to 30 day hypokinesia was studied. Hypokinetic females in a regular diet produced offspring in 33 percent and those on an enriched diet in 50 percent cases. The same values were obtained in exercising rats, the time allowed for their exercises making 3 percent of the total experimental time. A combined used of an enriched diet and exercises resulted in a 100 percent increase of pupping events. A.R.H.

N81-10678 Joint Publications Research Service, Arlington, Va.
STUDIES OF CENTRAL AND REGIONAL HEMODYNAMICS BY ISOTOPE AND IMPEDENCE METHODS DURING LBNP **c52**
Kh. Kh. Yarullin, T. V. Benevolenskaya, V. I. Lobachik, T. D. Vasilyeva, V. A. Gornago, V. V. Degtyarenko, and N. F. Tarasov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 99-104 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 66-70 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

The potential of impedance and isotope (intravenous injections of I-131 and In-113m In) methods to study regional and central hemodynamics was investigated on 12 test subjects exposed to LBNP. Both methods demonstrated marked changes in blood filling of the head and the chest, particularly during the first minutes of LBNP tests. This occurred together with a drastic increase in leg blood filling. The close similarity of regional hemodynamic changes detected by the two methods gives evidences that the simple and noninvasive impedance method can be well used for the above studies. Author

N81-10679 Joint Publications Research Service, Arlington, Va.
CHANGES IN MAIN PARAMETERS OF HUMAN HEMODYNAMICS WITH LOWER BODY COMPRESSED IN A G SUIT **c52**
L. I. Letkova and K. I. Murakhovskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 105-110 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 70-73 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

Changes in cardiovascular parameters of test subjects wearing anti-G suits are studied under static conditions. Methods of radioactive label dilution, radiocardiography, and tetrapolar rheography were used. Results show that the highest level of physiological reactions, within short transition periods immediately after inflation and deflation of suit bladders. At the same time, in the course of compression, there is some tendency toward recovery of the base volumetric characteristics of circulation, which can apparently be considered a manifestation of compensatory reactions in response to mechanical compression of the lower body. M.G.

N81-10680 Joint Publications Research Service, Arlington, Va.
AUTOMATIC CONTROL OF GAS EXCHANGE IN THE AUTOTROPHIC COMPONENT OF A LIFE SUPPORT SYSTEM FOR HETEROTROPHIC ORGANISMS **c52**
V. L. Korbut *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 111-116 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 73-77 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

An automatic gas exchange control system for the autotrophic component in the life support system of heterotrophic organisms is described and tested. Wheat grown in a sealed phytotron was used as the model of the autotrophic element. The heterotrophic element was modeled by four albino rats put into a special airtight chamber. A high efficiency of the automatic gas exchange control system of plants integrated with animals is demonstrated. Balance characteristics of the integrated gas exchange in the plant-animal system are provided. M.G.

N81-10681 Joint Publications Research Service, Arlington, Va.
USE OF ULTRAVIOLET INSTRUMENT FOR MONITORING THE QUALITY OF RECLAIMED DRINKING WATER **c54**
S. V. Chizhov, Yu. Ye. Sinyak, M. I. Shikina, and T. D. Kalinichenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 117-120 refs Transl. into ENGLISH from Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 77-79 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

The possibility of using a luminescence method for ongoing monitoring of the quality of drinking water reclaimed from the condensate of atmospheric moisture (CAM) and obtained from dissociation of hydrogen peroxide is explored. A semiautomatic ultraviolet fluorimeter was utilized. The sensitivity of the instrument to elementary alcohols and acids and construction materials used in the reclamation system was tested. The findings revealed that the sensitivity of the ultraviolet instrument constituted 0.001 percent for alcohols and 0.0001 percent for acids. Studies of construction materials revealed that, in experiments with distilled water, the resins and charcoals of the tested brands had no effect on the readings (in millivolts) of the luminescence instrument. Upon sorption purification of the CAM substitute, gel-like ion exchange resins imparted luminescence to reclaimed water. Such a phenomenon was not observed with use of porous ion exchange resins. Additional results and recommendations are given. M.G.

N81-10682 Joint Publications Research Service, Arlington, Va.
CHOICE OF METHOD FOR LONG-TERM STORAGE OF NUTRIENT SOLUTIONS USED TO GROW VEGETABLES **c43**
I. V. Gribovskaya, I. A. Gladchenko, O. I. Novoselova, G. S. Petrov, and L. L. Martynenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 121-125 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 79-81 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

Storage methods for nutrient solutions used to raise higher plants under space flight conditions are investigated. Conditions that permit storage of nutrient solution for three months in a

stable state, without sediment, and with maximum possible concentrations of constituents are identified. Tests are described which examined the construction materials used for corrosion, possible changes in solution pH, precipitation of a saline sediment, and sorptive and desorptive properties of materials with regard to minerals. M.G.

N81-10683 Joint Publications Research Service, Arlington, Va.
METHOD FOR PRODUCING CLINOSTATIC HYPOKINESIA IN MONKEYS
T. G. Urmancheyeva and A. A. Dzhokua *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 126-130 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 82-84 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

A method of producing clinostatic hypokinesia in monkeys is described. Monkeys (Macaca rhesus) were restricted by overalls, which buttoned in the back and had an opening in the perineal region. Over the entire length of the suit, from the arm hole to the ankle joint, pairs of tapes were stitched into the side seams at a certain distance from one another. These tapes are passed through openings that were made in a canvas-covered cot and tie the overalls to the cot. With such immobilization, the animal's legs are extended in the hip and knee joints. It retains freedom of movement in all of the arm articulations and in the ankles. The monkey was turned from back to abdomen periodically, every 2-3 days. An intact monkey was kept immobilized under these conditions for 45 days. On the whole, the disturbances that developed (weight loss, decreased volume and tonus of muscles of the lower extremities, statokinetic disturbances) and dynamics thereof in the readaptation period were similar to those seen in man submitted to long term clinostatic hypokinesia. M.G.

N81-10684 Joint Publications Research Service, Arlington, Va.
CERTAIN PERSONALITY CHARACTERISTICS AS RELATED TO SUCCESS OF PILOT TRAINING **c53**
Ye. V. Bannov and V. S. Lozinskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 131-136 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 84-87 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

The overall correlation between measured personality traits and such indicators of achievement in flight training level of development of the main mental processes, flying skills, training, and check out flying hours in basic flight training is studied. The survey methodologies are described which incorporate a 16 factor analysis of the personality. Results indicate that the well achieving cadets are characterized by such personality traits as higher intelligence than poor achievers, emotional stability, rationality, decisiveness, conscientiousness, courage, broad interests, practicality, leadership, vigor, good control over behavior and emotions, and sincerity. M.G.

N81-10685 Joint Publications Research Service, Arlington, Va.
BIOASTRONAUTICS YESTERDAY, TODAY AND TOMORROW
V. V. Budilovskiy and V. B. Pishchik *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 137-144 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 88-92 (For primary document see N81-10663 01-51)
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A brief overview of major directions of bioastronautical research on the international scene is presented. The spaceborne experiments of the space shuttle and space lab missions are emphasized. M.G.

N81-10686 Washington State Univ., Pullman.
CALCIUM UPTAKE IN TRAINED AND EXHAUSTED ANIMALS Ph.D. Thesis
Marie Beauregard 1980 67 p
Avail: Univ. Microfilms Order No. 8025904

The effects of training or exhaustion in rats and hamsters were evaluated by measurements of succinate dehydrogenase (SDH) activity, colonic temperatures, glycogen depletion, and calcium uptake by the sarcoplasmic reticulum (SR). In the rat study, the training consisted of running on a treadmill for 1 hr/day for 5 days/wk at 26.8 m/min for 12 wks. Training induced a higher SDH avtivity in the trained rats ($P < 0.01$) than in the nontrained rats. Exhaustion procedure consisted of running on the treadmill at 20 m/min for the first hr., and then enhancing the workload by increasing the treadmill speed every hour or half hour thereafter. Colonic temperatures reached 41 C for both nontrained and trained exhausted rats. Training did not affect the magnitude of the glycogen depletion produced by exhaustion in either the gastrocnemius muscle or in liver. The transient depression in calcium uptake found in nontrained exhausted rats supports the contention that exhaustion is not caused by a severe impairment of SR functioning in nontrained animals. Dissert. Abstr.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-10687 Illinois Univ., Urbana.
THE ROLE OF PLASMA PROTEINS IN THE MAINTENANCE OF VASCULAR VOLUMES Ph.D. Thesis
Margaret Anne Kolka 1980 50 p
Avail: Univ. Microfilms Order No. 8024575

For adult males volunteered to participate in an incremental exercise test at five submaximal exercise intensities, as well as during maximal exercise. Prior to the exercise bout, each subject was equilibrated (0.5 hr) in both supine and upright positions. During each rest and exercise period, standard metabolic measurements were made, core temperature recorded and a peripheral venous blood sample drawn from an indwelling catheter in the cubital (arm) area. In each blood sample, the whole blood hemoglobin concentration, the hematocrit and the plasma concentrations of the total plasma proteins, albumin and the total globulin were determined. It suggested that the fluid volume alterations observed were the result of hydrostatic forces with resultant water movement out of the vascular bed, and were not due to any active processes involving redistribution of proteins with the various fluid compartments. Dissert. Abstr.

N81-10688 Virginia Univ., Charlottesville.
STUDIES IN RESPIRATORY CONTROL Ph.D. Thesis
Matthew Lincoln Severns 1980 272 p
Avail: Univ. Microfilms Order No. 8024039

The control of respiration was studied. The interaction of the carotid chemoreceptor signals with the signals from other systemic sensors in providing a net drive to breathe was investigated. The chemoreceptor interaction was analyzed by separately perfusing the carotid sinuses from a set of gas exchangers to see whether or not the level of systemic stimulation or the order of presentation of stimuli affect the overall interaction. It was found that the stimuli combine in a less than additive manner. A mathematical model of the chemoreceptors in the ventrolateral surface of the medulla was constructed. These chemoreceptors are the dominant ones in determining the ventilatory response to changes in arterial carbon dioxide concentration. It was shown that a distributed parameter model commonly used to study oxygen transport to tissue (Krogh model) can be reduced to a lumped parameter model by space averaging of concentrations. Dissert. Abstr.

N81-10689 Missouri Univ. - Columbia.
AN AUTOMATED INDIRECT BLOOD PRESSURE INSTRUMENT BASED UPON ULTRASOUND Ph.D. Thesis
Chriswell Gene Hutchens 1979 194 p
Avail: Univ. Microfilms Order No. 8024362

The design, development and testing of an instrument for indirect determination of dog blood pressure is presented. The instrument uses ultrasonic wall velocity characterization techniques for determination of blood pressure. The blood pressure measurement instrument which is based upon a 6802 microprocessor, consists of a cuff with ultrasonic wall velocity transducer, liquid crystal display and a microcomputer for control and determination

of systolic and diastolic blood pressures. Wall velocity and cuff pressure are digitized by the microcomputer. The results of 90 blood pressure determination on six dogs over pressure ranges from less than 50 torr to greater than 200 torr are presented. The analysis of data indicates that 80 percent of the time blood pressure determination will be + or - 10 and + or - 16 torr for systolic and diastolic pressure respectively. The instrument is demonstrative of the feasibility for a multispecies instrument. Dissert. Abstr.

N81-10690# Dunlap and Associates, Inc., La Jolla, Calif. Western Div.

MEASURES OF NAVY PILOT WORKLOAD, SLEEP AND PERFORMANCE IN STRESSFUL ENVIRONMENTS Final Report

Clyde A. Brictson and Peter A. Young Jan. 1980 94 p refs (Contract N00014-77-C-0066; NR Proj. 201-284)
(AD-A087131) Avail: NTIS HC A05/MF A01 CSCL 05/10

Measures of Navy pilot workload, sleep and landing performance collected under two stressful environments--carrier deployment and carrier landing qualification are analyzed and described. The study was conducted to demonstrate the application and utility of data collection techniques in operational environments and to describe the typical workload and sleep activity of Navy pilots. Attack pilots and LSOs averaged 12 hour workdays at sea and supplemented their sleep by short naps during flying periods. Landing performance for attack aviators was remarkably high with boarding rates at night averaging 93 percent for the entire deployment. Performance decrement was noted both day and night only after extensive in port periods of flight inactivity. Recommendations and summary data are discussed. GRA

N81-10691# Duke Univ., Durham, N. C. Dept. of Opthamology.

RESEARCH ON GANGLION CELL RESPONSES AFTER LASER EXPOSURE OF THE RETINA Final Report, Jan. 1977 - Dec. 1978

Myron L. Wolbarsht May 1980 51 p refs
(Contract F33615-77-C-0609; AF Proj. 7757)
(AD-A087269; SAM-TR-80-18) Avail: NTIS HC A04/MF A01 CSCL 06/18

Electrophysiological recordings were made from retinal ganglion cells in the macula (including fovea) of several species of Macaque monkeys. After exposure to high-intensity argon or HeNe lasers both above and below the lesion level, the receptive fields lacked a peripheral portion. This was accompanied by a slight increase in the central portion of the receptive field. Some quite large receptive fields were found around the fovea, often extending through it. The large receptive fields could also extend through the site of a laser lesion. No unsymmetrical changes in the receptive field were seen, even in receptive fields adjacent to, or partially within, a laser lesion site. Histological examination did not show any changes in the retinal organization adjacent to laser lesion even where the ganglion cells had center-only receptive fields. GRA

N81-10692# Michigan State Univ., East Lansing. Dept. of Biomechanics.

THE ACCURACY OF SCREW AXIS ANALYSIS USING POSITION DATA FROM ANATOMICAL MOTION STUDIES Annual Report, 1 Nov. 1978 - 31 Oct. 1979

Marcus H. Jeffrey 5 May 1980 81 p refs
(Contract F49620-78-C-0012; AF Proj. 2313)
(AD-A089446; AFOSR-80-0868TR) Avail: NTIS HC A05/MF A01 CSCL 06/2

Research involving the kinematics of human joint mobility often involves screw axis analysis. As a prelude to such research a screw axis analysis program was developed and implemented for use in the Systems Anthropometry Laboratory. This report presents a detailed discussion of the algorithm used to find Displacement Matrices (DM) and screw axis parameters. Error propagation due to uncertainty in DM is analytically developed and then demonstrated. The rotation angle is found to be the most critical screw axis parameter, and the components of a unit vector in the direction of the screw axis are the most sensitive to error. Using the condition number of a matrix, a method is developed and presented for evaluating the error propagation due to the matrix operations used to find DM. GRA

N81-10693# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.

POSTMORTEM CORONARY ATHEROSCLEROSIS FINDING IN GENERAL AVIATION ACCIDENT PILOT FATALITIES: 1975 - 1977

C. F. Booze, Jr., J. K. Pidkowicz, A. W. Davis, and F. A. Bolding Feb. 1980 13 p refs
(AD-A089428; FAA-AM-80-8) Avail: NTIS HC A02/MF A01 CSCL 06/5

The autopsies of 764 pilots involved in fatal general aviation accidents during the years 1975-1977 were reviewed to appraise the age specific prevalence of coronary atherosclerosis among the autopsied group. Fifty-one percent of the pilots killed in aircraft accidents and autopsied during 1975-77 were found to have some degree of coronary atherosclerosis ranging from minimal to severe. However, only about 5 percent of the autopsied group were categorized as having severe coronary atherosclerosis. The rate per 1,000 of severe coronary atherosclerosis increased with age from 14.5 for ages less than 30 to 89.9 for ages 50 years and above, with the rate nearly tripling from ages 30-39 to 40-49 (22.1 to 63.6). While the findings of this study are consistent with, and do parallel, the findings of other recent autopsy studies, the prevalence of coronary atherosclerosis among this group of autopsied airmen is less than would have been expected based on the results of these other studies. GRA

N81-10694# Virginia Polytechnic Inst. and State Univ., Blacksburg. Human Factors Lab.

DIGITAL IMAGE PROCESSING SYSTEMS AND AN APPROACH TO THE DISPLAY OF COLORS OF SPECIFIED CHROMINANCE

Willard W. Farley and James C. Gutmann 1 Aug. 1980 40 p refs
(Contract N00014-78-C-0238; NR Proj. 196-155)
(AD-A089587; VPI-HFL-80-ORNL-80-2) Avail: NTIS HC A03/MF A01 CSCL 05/5

The recent proliferation of color displays has accentuated the need for a metric of color contrast which can be used to predict human operator performance. To obtain the data for forming a metric of color contrast, one needs the capability of presenting a broad range of colors in varing geometric arrangements. This report describes an approach to developing the capability to display colors of known chromaticity using a color digital image processing system. This report covers the development of measurement technique and software used in characterizing the display system, the reduction of spectroradiometric data, the use of color mixing equations for color digial image processing systems, and the development of display system software. GRA

N81-10695# European Space Agency, Paris (France).

A METHOD FOR SEMI-AUTOMATIC ANALYSIS OF EYE MOVEMENTS

Hans Radke Jun. 1980 28 p refs Transl. into ENGLISH of "Ein Verfahren zur Teilautomatisierten Auswertung von Blickbewegungsmessungen" Rept. DFVLR-Mitt-79-02 DFVLR, Brunswick, Dec. 1978 Original report in GERMAN previously announced as N80-23005
(ESA-TT-475; DFVLR-Mitt-79-02) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 7,80

The measurement and analysis of the operator's visual behavior is described in terms of its importance as a tool for human factor research on the layout of displays and controls. However, the analysis of eye point of regard data is difficult and time consuming. A semiautomatic computer aided procedure is described, which reduces the time needed for data analysis. Author (ESA)

N81-10696# European Space Agency, Paris (France).

THE INFLUENCE OF HYPERBARIC ENVIRONMENT IN COMBINATION WITH WORKLOAD AND CONFINEMENT ON HUMAN INFORMATION PROCESSING

Klaus-Martin Goerters Dec. 1979 16 p refs Transl. into ENGLISH from 'Die Beeinflussung der geistigen Konzentrationsfaehigkeit durch Ueberdruck unter beruecksichtigung der zusaetzlichen Belastungsfaktoren Arbeitsbeanspruchung u. Isolation', DFVLR, Bad Godesberg, West Germany, Report DFVLR-FB-78-12, Jul. 1978 Original report in GERMAN previously announced as N79-30926 Original German report available from DFVLR,

Cologne DM 8,20
(ESA-TT-567; DFVLR-FB-78-12) Avail: NTIS HC A02/MF A01

A test requiring perceptual speed, memory, and numerical ability was given to subjects before and during working conditions with varying degrees of work load, confinement, and ambient pressure. Results demonstrate that high workload and confinement for several days do not lower the test scores, but rising partial pressure of nitrogen results in performance decrements. These decrements are already present at an N2 partial pressure of 3 bar abs. Author (ESA)

N81-10697*# New Mexico Univ., Albuquerque.
ALTITUDE ACCLIMATIZATION. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE
Progress Report, 1974 - Jul. 1980
Samuel C. Mauk Aug. 1980 40 p Supersedes NTIS/PS-79/0857 Sponsored in part by NASA and NTIS
(NASA-CR-163672; PB80-813512; NTIS/PS-79/0857) Avail: NTIS HC $30.00/MF $30.00 CSCL 06P

This bibliography of citations to the international literature covers aspects of altitude acclimatization. Included are articles concerning high altitude environments, hypoxia, heart function and hemodynamic responses, physical exercise, human tolerances and reactions, physiological responses, and oxygen consumption. This updated bibliography contains 164 citations, 35 of which are new entries to the previous edition. GRA

N81-10499# Joint Publications Research Service, Arlington, Va.
FUTURE, IMPACT OF BIOMEDICAL RESEARCH EXAMINED
In its West Europe Rept.: Sci. and Technol., No. 14 (JPRS-75070) 5 Feb. 1980 p 11-19 Transl. into ENGLISH from Le Monde (France), 10 Nov. 1979 9 p (For primary document see N81-10497 01-42)
Avail: NTIS HC A04/MF A01

N81-10664 Joint Publications Research Service, Arlington, Va.
FLUID-ELECTROLYTE HOMEOSTASIS AND WEIGHTLESSNESS
O. G. Gazenko, A. I. Grigoryev, and Yu. V. Natochin *In its* USSR Rept: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 1-11 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 3-10 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10665 Joint Publications Research Service, Arlington, Va.
PROBLEMS AND PROSPECTS OF SPACE PHARMACOLOGY
V. S. Shaskov and V. V. Sabayev *In its* USSR Rept: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 12-28 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 10-20 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10666 Joint Publications Research Service, Arlington, Va.
BIORHYTHMOLOGICAL STATUS AS ONE OF THE CRITERIA FOR COSMONAUT SCREENING
S. I. Stepanova *In its* USSR Rept: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 29-34 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 20-24 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10667 Joint Publications Research Service, Arlington, Va.
STUDY OF THE COMBINED EFFECT OF ANTIORTHOSTATIC POSITION AND LBNP ON MAN'S TRACKING ACCURACY AND SPATIAL ORIENTATION
B. B. Bokhov, B. B. Yegorov, A. A. Savilov, and Yu. N. Taranenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 35-45 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 25-28 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10668 Joint Publications Research Service, Arlington, Va.
CIRCULATORY REACTIONS OF FIRST CREW OF THE SALYUT-6 ORBITAL TEST WITH LBNP
V. A. Degtyarev, L. Ya. Andriyako, V. M. Mikhaylov, V. N. Ragozin, Zh. G. Adamchik, I. V. Alferova, V. A. Andretsov, and A. N. Kozlov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 41-45 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 29-32 (For primary document see N81-10663 01-52)
Avail: NTIS HC A07

N81-10669 Joint Publications Research Service, Arlington, Va.
DYNAMICS OF DIASTOLIC PHASE STRUCTURE DURING A 140 DAY SPACE FLIGHT
I. V. Alferova, A. D. Yegorov, and A. P. Polyakova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 46-50 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 32-35 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10670 Joint Publications Research Service, Arlington, Va.
RESULTS OF INFLIGHT ELECTROCARDIOGRAPHIC STUDIES OF SALYUT-5 CREW
V. A. Degtyarev, V. S. Bednenko, V. K. Gabyshev, V. A. Sapozhnikov, and V. P. Sidorov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Nov. 1980 p 51-55 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 35-38 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10672 Joint Publications Research Service, Arlington, Va.
EFFECT OF SOME FACTORS THAT SIMULATE SPACE FLIGHTS ON BLOOD PLASMA LEVELS OF FREE AND PROTEIN-BOUND 11-HYDROXYCORTICOSTEROIDS
S. S. Kalandarov, V. P. Bychkov, A. S. Ushakov, and G. I. Proskurova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 63-69 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 43-47 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10673 Joint Publications Research Service, Arlington, Va.
RENAL FUNCTION AND GLUCOCORTICOID ACTIVITY OF THE ADRENAL CORTEX DURING IMMERSION
I. S. Balakhovskiy and V. B. Noskov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 70-74 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 47-50 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10674 Joint Publications Research Service, Arlington, Va.
ERYTHROCYTE BALANCE DURING 182-DAY HYPOKINESIA
T. Ye. Burkovskaya, A. V. Ilyukhin, V. I. Lobachik, and V. V. Zhidkov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 75-80 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 50-54 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10675 Joint Publications Research Service, Arlington, Va.
EFFECT OF PROLONGED ANTIORTHOSTATIC POSITION ON CARDIAC BIOELECTRICAL ACTIVITY ACCORDING TO EKG TRACINGS FROM CORRECTED ORTHOGONAL LEADS
V. D. Turbasov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 81-87 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med.

(Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 54-59 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10678 Joint Publications Research Service, Arlington, Va.
STUDIES OF CENTRAL AND REGIONAL HEMODYNAMICS BY ISOTOPE AND IMPEDENCE METHODS DURING LBNP
Kh. Kh. Yarullin, T. V. Benevolenskaya, V. I. Lobachik, T. D. Vasilyeva, V. A. Gornago, V. V. Degtyarenko, and N. F. Tarasov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 99-104 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 66-70 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10679 Joint Publications Research Service, Arlington, Va.
CHANGES IN MAIN PARAMETERS OF HUMAN HEMODYNAMICS WITH LOWER BODY COMPRESSED IN A G SUIT
L. I. Letkova and K. I. Murakhovskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 105-110 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 70-73 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10680 Joint Publications Research Service, Arlington, Va.
AUTOMATIC CONTROL OF GAS EXCHANGE IN THE AUTOTROPHIC COMPONENT OF A LIFE SUPPORT SYSTEM FOR HETEROTROPHIC ORGANISMS
V. L. Korbut *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 111-116 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 73-77 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N81-10698 Kansas Univ., Lawrence.
THE MAP CONTEXT AS A SOURCE OF PERCEPTUAL ERROR IN GRADUATED CIRCLE MAPS Ph.D. Thesis
Patricia Purcell Gilmartin 1980 167 p
Avail: Univ. Microfilms Order No. 8026675

Psychological theory suggests that the nature of the context within which a map symbol is placed can influence the perceived characteristics of the symbol. It was hypothesized that the apparent size of proportional circles on a map would be affected by certain properties of the visual environment of the map. The variables examined were (1) the effect of size contrast between a test circle and closely adjacent circles; (2) the presence or absence on the map of internal borders; and (3) the size of the test circle, itself. A psychophysical test was used to measure the extent to which the perceived sizes of test circles was biased by each of these variables. Analysis of variance techniques determined the statistical significance of the findings for each variable and all combinations of variables. Results indicate that size contrast between a given map symbol and other elements of the visual environment can alter the perceived size of the symbol. Perceptions are relatively accurate when anchored by a legend consisting of at least three circles. Dissert. Abstr.

N81-10699# Yale Univ., New Haven, Conn. School of Organization.
THE METHODOLOGY OF DIAGNOSING GROUP AND INTERGROUP RELATIONS IN ORGANIZATIONS
Clayton P. Alderfer Jun. 1980 42 p refs
(Contract N00014-79-C-0626; NR Proj. 170-891)
(AD-A087474; CPA-80-5) Avail: NTIS HC A03/MF A01 CSCL 05/10

The aim of organizational diagnosis is to produce learning about the system for its members. Diagnosis is a process consisting of three phases: entry, data collection, and feedback. Each phase has its own primary and secondary objectives that contribute to the work of the other phases. As a result, organizational diagnosis is a self-correcting process that permits the activities of subsequent phases to build upon the accomplishments of earlier periods and to correct limitations that arise from the inevitably incomplete work that must occur with dynamic living systems. The process of organizational diagnosis is shaped by the condition of the system being studied. The effects of underbounded and overbounded organizations influence what will happen to diagnosticians as they attempt to proceed with entry, data collection, and feedback. Respondent system dynamics in part determine the consequences of using certain diagnostic techniques. The effect of the intersection between the diagnostic process and an understanding of system dynamics is to establish a series of contingencies that suggest which techniques in what order are most appropriate to particular system conditions. GRA

N81-10700# Yale Univ., New Haven, Conn. School of Organization and Management.
GROUP INTERGROUP RELATIONS IN LIVING HUMAN SPECIES
Clayton P. Alderfer Jun. 1980 58 p refs
(Contract N00014-79-C-0626; NR Proj. 170-891)
(AD-A087473; CPA-80-4) Avail: NTIS HC A04/MF A01 CSCL 05/10

Understanding group and intergroup relations in living human systems takes three orders of conceptual framework. The first pertains to those aspects of groups that share properties with all living systems. The second deals with properties of three levels of human systems: individuals, groups, and organizations. And the third uses concepts uniquely suited to the phenomena of group and intergroup relations in organizations. The concept of parallel processes explains interdependence of phenomena at the different levels of analysis and provides a means to relate dynamic processes in human systems and in the diagnostic process itself. As presented in chapter one, the philosophy of clinical social science dictates that investigators examine themselves as well as the phenomena they study. Therefore, the concepts presented here are intended for use not only by investigators to understand groups and social systems but also to observe and change themselves, if appropriate, as they conduct research. The theory applies to the researched and to the researcher. GRA

N81-10701# Decision Research Corp., Eugene, Oreg.
HOW WELL DO PROBABILITY EXPERTS ASSESS PROBABILITIES? Technical Report, Jan. - Aug. 1980
Sarah Lichtenstein and Baruch Fischhoff Aug. 1980 32 p refs
(Contract N00014-80-C-0150)
(AD-A089619; PTR-1092-80-8) Avail: NTIS HC A03/MF A01 CSCL 05/10

Past research on people's ability to assess probabilities has shown two common errors, overconfidence in one's knowledge and insensitivity to task difficulty. This research has created a new class of experts: those who have studied probability assessors and who are aware of the common errors. The performance of eight such experts is here compared to the performance of twelve untrained subjects and fifteen who had previously received training in probability assessment. All subjects responded to 500 general-knowledge items whose difficulty could be measured a priori from the item context. The experts appeared to have overcorrected for the overconfidence error: they were notably underconfident, whereas the untrained subjects were overconfident and the trained subjects were mixed. The experts were more sensitive than the other two groups to variations in item difficulty. However, even they showed a substantial insensitivity to difficulty, relative to ideal performance. Introspection suggests that this second error would be hard to overcome. GRA

N81-10702# Research Inst. of National Defence, Stockholm (Sweden).
VISUAL EFFECTS OF SAMPLING IN DIGITAL PICTURE PROCESSING. A PILOT STUDY
Lena Linde, Hans Marmolin, and Sten Nyberg Feb. 1980 33 p refs

(FOA-C-53001-H9) Avail: NTIS HC A03/MF A01

Experiments were designed to study how sampling distortions due to aliasing and band limitation are perceived and affect image quality. Sampling effects were investigated with two different scenes. The first experiment comprised ratings of subjective similarity between pictures processed with different combinations of prefiltering and sample frequency. The second experiment comprised subjective ratings of similarity between pictures processed with different combinations of white Gaussian noise and sample frequency. The similarities were analyzed by a multidimensional scaling technique (INDSCAL). The multidimensional analyses indicated that the subjective sampling effects could appear as unhomogeneous noise texture (false spots), illdefined contours, displaced contours or loss of pattern elements; however, the saliency of each dimension was found to depend on scene properties. Author (ESA)

N81-10703# European Space Agency, Paris (France).
A STUDY ON PILOT/OBSERVER INTERACTION IN ALIGNING A HELICOPTER WITH A TARGET
Erhard Danneberg Jan. 1980 32 p refs Transl. into ENGLISH of "Untersuchung des Zusammenwirkens von Pilot und Beobachter beim Ausrichten des Hubschraubers auf ein Ziel", Rept. DFVLR-FB-79-04, DFVLR, Brunswick, Nov. 1978 Original report in GERMAN previously announced as N79-30945
(ESA-TT-480; DFVLR-FB-79-04) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8,70

Speed and stability of the alignment of a helicopter with a target are investigated by means of a system simulation. Variables are the maximum yaw rate of the helicopter, the maximum pan rate of the steerable sight or sensor, and their optical magnification. The results obtained provided favorable combinations of these parameters for two different cases, i.e., target acquisition and target already picked up by means of the sight or sensor, respectively. Author (ESA)

N81-10671 Joint Publications Research Service, Arlington, Va.
FUNCTIONAL ASYMMETRY OF OPERATOR PERFORMANCE
A. G. Fedoruk and T. A. Dobrokhotova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 56-62 refs Transl. into ENGLISH Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, No. 5, Sept. - Oct. 1980 p 39-42 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

N81-10684 Joint Publications Research Service, Arlington, Va.
CERTAIN PERSONALITY CHARACTERISTICS AS RELATED TO SUCCESS OF PILOT TRAINING
Ye. V. Bannov and V. S. Lozinskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 131-136 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 84-87 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-10681 Joint Publications Research Service, Arlington, Va.
USE OF ULTRAVIOLET INSTRUMENT FOR MONITORING THE QUALITY OF RECLAIMED DRINKING WATER
S. V. Chizhov, Yu. Ye. Sinyak, M. I. Shikina, and T. D. Kalinichenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 5, 1980 (JPRS-7627) 30 Oct. 1980 p 117-120 refs Transl. into ENGLISH from Biol. Aviakosm. Med. (Moscow), v. 14, no. 5, Sep. - Oct. 1980 p 77-79 (For primary document see N81-10663 01-51)
Avail: NTIS HC A07

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N81-10704# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronic Warfare Lab.
MICROCOMPUTER INTERFACING TECHNIQUES Final Report, 1 Feb. 1979 - 1 Feb. 1980
John T. Cervini Jul. 1980 42 p refs
(DA Proj. 1T1-62715-A-042)
(AD-A088637; DELET-TR-80-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

A number of parallel interfacing methods for microcomputer systems are discussed which use the Motorola 6800 microprocessor as a central processing unit. A minimum processing system is defined, and the individual electronic components are defined and explained. The report also illustrates the requirements of the Peripheral Interface Adapter integrated circuit in effecting the Input/Output of data. The techniques and instructions necessary to interface signal generators, printers, and data acquisition systems to a microcomputer are also described. GRA

N81-10705# Colorado Univ. at Boulder. Dept. of Computer Science.
A PRECISE AND EFFICIENT ALGORITHM FOR DETERMINING EXISTENTIAL SUMMARY DATA FLOW INFORMATION
Eugene W. Myers, Jr. Mar. 1980 40 p refs
(Grants DAAG29-80-C-0094; NSF MCS-77-02194)
(AD-A089195; CU-CS-175-80; ARO-17124.2-M23) Avail: NTIS HC A03/MF A01 CSCL 09/2

Data flow analysis is well understood at the intraprocedural level and efficient algorithms are available. When interprocedural mechanisms such as recursion, procedure nesting, and pass by reference parameters are introduced, the data flow problems become more difficult. Let ISIZE be the size of the problem and OSIZE be the size of the resulting data flow relation. An O(ISIZE OSIZE) algorithm is demonstrated for the existential summary data flow problem. GRA

N81-10706# Naval Postgraduate School, Monterey, Calif.
DYNAMIC LINKING IN A MICROCOMPUTER ENVIRONMENT
Gerald B. Blanton and Robert R. Schell May 1980 32 p refs (RR0000110)
(AD-A089284; NPS52-80-008) Avail: NTIS HC A03/MF A01 CSCL 09/2

The design of a dynamic linker for use with modern microcomputers is introduced. The basic concepts for resolving symbolic interprocedure references at execution time are reviewed,

and the means to support shared data and (pure) procedures are explained. The mechanism (modules and data bases) suitable for microcomputers without the hardware features previously considered necessary for dynamic linking are described. The major implications for the associated operating system and language translators are identified. GRA

N81-10707# Wisconsin Univ. - Madison. Mathematics Research Center.
ARACHNE USER GUIDE, VERSION 1.2
Raphael Finkel and Marvin Solomon Apr. 1980 59 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A089609; MRC-TSR-2066) Avail: NTIS HC A04/MF A01 CSCL 09/2

Arachne is a multicomputer operating system running on a network of LSI-11 computers at the University of Wisconsin. This document describes Arachne from the viewpoint of a user or a writer of user level programs. All system service calls and library routines are described in detail. In addition, the command line interpreter and terminal input conventions are discussed. Companion reports describe the purpose and concepts underlying the Arachne project and give detailed accounts of the Arachne utility kernel and utility processes. GRA

N81-10708# Delta Information Systems, Inc., Jenkintown, Pa.
USE OF A MICROPROCESSOR TO IMPLEMENT AN ADCCP PROTOCOL, FEDERAL STD-1003, OPERATING IN THE UNBALANCED NORMAL MODE Final Report
Stephen J. Urban and Richard A. Schaphorst May 1980 91 p
(Contract DCA100-79-M-0190)
(AD-A089628; AD-E100394; NCS TIB-80-2) Avail: NTIS HC A05/MF A01 CSCL 09/2

The objective of this program is to develop block diagrams, flow charts, and computer programming for the unbalanced normal class of procedures in accordance with Federal Standard 1003 'Telecommunications Synchronous Bit Oriented Data Link Control Procedures (Advanced Data Communication Control Procedures)'. The purpose of this effort is to determine the feasibility of using the M6800 or similar microprocessor, to implement this type of protocol, and to obtain an estimate of memory and processor resources that would be required. GRA

N81-10709# Royal Radar Establishment, Malvern (England).
AN INTRODUCTION TO THE FLEX COMPUTER SYSTEM
J. M. Foster, C. I. Moir, I. F. Currie, J. A. M. McDermid, P. W. Edwards, J. D. Morison, and C. H. Pygott London HMSO Oct. 1979 28 p refs
(RSRE-79016; BR73084) Avail: NTIS HC A03/MF A01

The development of the FLEX system, a high performance, multicomputer system is described. The FLEX system has an instruction set oriented towards compiler generation of code, and aids in security and parallel processing. The peripherals are controlled by a subsidiary computer. The intercomputer communication is provided by a packet switching network which is fast enough to allow sharing of peripherals and secondary storage. A high level description of the FLEX processor and memory, the peripheral control subsystem and COMFLEX, the communications subsystem is given, as well as an overview of the processor architecture at the macrocode level. The operating system and user program facilities provided on the machine are described. Author (ESA)

N81-10710# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computer Science.
A PROTOCOL FOR SECURE COMMUNICATION
D. W. Davies and W. L. Price Nov. 1979 38 p ref
(NPL-NACS-21/79) Avail: NTIS HC A03/MF A01

A protocol is outlined which was devised with the intention of its forming the basis for a practical implementation experiment in which secure calls will be carried by an X-25 network. Both Data Encryption Standard (DES) and public key cryptosystems are envisaged; two public key systems are mentioned, the Rivest, Shamir, and Adleman (RSA) and knapsack algorithms. It is intended that the protocol should be capable of accommodating further cryptographic systems as these become available. A provision for signatures and formats for initial messages and data messages is described. Author (ESA)

N81-10711# National Technical Information Service, Springfield, Va.
MICROCOMPUTERS: BASIC DESIGN AND DEVELOPMENT. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Jun. 1978 - Jun. 1979
Brian Carrigan Jul. 1980 218 p Supersedes NTIS/PS-79/0730; NTIS/PS-78/0615
(PB80-812647; NTIS/PS-79/0730; NTIS/PS-78/0615) Avail: NTIS CSCL 09B

A bibliography containing 211 abstract addressing the design and development of microcomputers is presented. Studies on software development, chip development, LSI technology, and reliability and performance evaluation testing are included. GRA

N81-10712# Federal Compiler Testing Center, Washington, D.C. Automated Data and Telecommunications Service.
TANDEM COMPUTERS, INC. COBOL-T9201D00, INDEXED I-O, MODULE LEVEL 1
13 Jun. 1980 10 p
(PB80-190267; FCTC/TR-80/04; CCVS74-VSR600) Avail: NTIS HC A02/MF A01 CSCL 09B

This technical report for the Indexed I-O Module of the TANDEM/16 T9201 COBOL Compiler Version D00 provides a consolidated summary of the results obtained from the evaluation of the subject compiler against the Indexed I-O Module of the 1974 COBOL standard. This technical report is made up of several sections showing the discrepancies found. A companion report (Validation Summary Report CCVS74-VSR600) provides information regarding the validation of the Compiler at the low intermediate level of Federal Standard COBOL. GRA

N81-10713# Federal Compiler Testing Center, Washington, D.C. Automated Data and Telecommunications Service.
TANDEM/16, FORTRAN-T9202D01
13 Jun. 1980 14 p
(PB80-190275; CCVS78-VSR605) Avail: NTIS HC A02/MF A01 CSCL 09B

This Validation Summary Report (VSR) for the TANDEM/16 T9202 FORTRAN Compiler Version D01 (GUARDIAN Version T9000D03) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1978 Fortran Standard (X3.9- 1978). The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies; a section relating the categories of discrepancies to the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N81-10982# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
THE HXR80M-BALLOON EXPERIMENT: A MICROPROCESSOR-CONTROLLED TRANSATLANTIC PAYLOAD
P. Ubertini, A. Bazzano, L. Boccaccini, C. LaPadula, M. Mastropietro, G. Medici, R. Patriarca, V. F. Polcaro, and F. Faggioni (PULSAR, S.R.L. Guidonia, Italy) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 425-429 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-10714 Yale Univ., New Haven, Conn.
MUTATION ANALYSIS OF PROGRAM TEST DATA Ph.D. Thesis
Timothy Alan Budd 1980 155 p
Avail: Univ. Microfilms Order No. 8025191

Mutation analysis asserts that those test cases are important which differentiate, in the sense of being correctly processed by one and incorrectly processed by the other, the original program from programs very similar in structure and meaning. These alternative programs are called mutants of the original. The power of this method is further increased by two observations: the coupling effect which asserts that complex errors can often be

detected by the analysis of a small set of simple alternatives; and the competent programmer hypothesis, which asserts that most programs are, when they reach the stage of development considered here, a close approximation to being correct. The mutation analysis method is first described in very general terms. Two very different directions are pursued: The first is to give formal meanings to the terms mutants, errors, coupling effect, and competent programmer and prove in a restricted programming domain a theorem concerning the coupling of simple and complex errors. Several results of this nature are proved for decision tables and for a set of linear recursive LISP programs. The second direction is to study a realistic programming language and to ask whether in a statistical sense the coupling effect occurs. A system to implement mutation analysis for FORTRAN programs is described and compared to other testing methods. Several further studies using this system are described, including analyses of the system's error detection capabilities, the machine and human resources it requires, and difficulties involved in using it. The last includes the problem of deciding whether a program and its mutant are computationally equivalent. A summary and a discussion of five possible areas for future research are included. Dissert. Abstr.

N81-10715 Carnegie-Mellon Univ., Pittsburgh, Pa.
SOFTWARE DEVELOPMENT CONTROL BASED ON SYSTEM STRUCTURE DESCRIPTION Ph.D. Thesis
Walter Franz Tichy 1979 209 p
Avail: Univ. Microfilms Order No. 8021192

An integrated software development and maintenance environment that supports communication and cooperation among programmers is discussed. A notation to describe the overall structure of a programmed system is the basis of the environment. This notation is a module interconnection language called INTERCOL. It can represent multiple versions and configurations, written in multiple programming languages. The environment establishes consistent interfaces among separately developed software components and maintains this consistency when modifications are made. It automates the management of interface changes by determining the affected components, alerting the responsible programmers, and preventing the use of inconsistent components. The environment coordinates the creation and change of source program versions and implements system generation in a multiversion, multiconfiguration environment. A prototype implementation is described. Dissert. Abstr.

N81-10716 Carnegie-Mellon Univ., Pittsburgh, Pa.
PROBLEM SOLVING IN SEMANTICALLY RICH DOMAINS Ph.D. Thesis
Ramamoorthi Bhaskar 1978 206 p
Avail: Univ. Microfilms Order No. 8020150

Semantically rich domains are domains that involve the use of large amounts of knowledge. Engineering thermodynamics, cost accounting and business policy were studied. In thermodynamics, knowledge consists of knowledge about devices, working substances and equations of state. This knowledge is represented as lists. The main problem solving program is a means ends scheme that is initiated by the absence of values of certain terms in the energy equation. Selected speeding up appears to be the main component of skill in thermodynamics. In cost accounting, the knowledge required is mainly knowledge of fifteen different formulae. A simple means ends scheme appears to be sufficient to describe problem solving in the domain. In business policy, the domain is characterized by lack of structure. Problem solving must focus on the effort to understand the text of the problem. A simple relation driven understanding scheme works well for this purpose. This scheme allows multiple objective decision making, an important component of business policy problems. Dissert. Abstr.

N81-10717 Kansas Univ., Lawrence.
TEXTURE ANALYSIS IN DIGITAL IMAGES USING IMAGE EXTREMA Ph.D. Thesis
Amrendra Singh 1980 180 p
Avail: Univ. Microfilms Order No. 8026704

The use of extrema as primitives for texture analysis in digital images is discussed. It is shown that the extrema and their derivatives, the unique reachability sets, are good texture primitives. Not only are they strongly linked to image structure, but they possess a number of properties for use in feature selection and computation. The attributes of the extremum and the reachability set primitives are discussed along with a general algorithm structure for their extraction. An unsupervised clustering scheme is developed which uses the attributes of the primitives to perform segmentation. While this scheme's memory requirements are low, it is of order S-square in time, where S is the number of primitives. To improve the efficiency of the segmentation step, a procedure which performs preliminary clustering to reduce the initial data is discussed. The concept involves treating the measurement space of the primitive vectors as a spatial domain, and then applying spatial clustering operators to it. Reduction in processing time by this method is quite high. Possible extensions for the use of the reachability set primitives are examined.
Dissert. Abstr.

N81-10718# Army Engineer Topographic Labs., Wright-Patterson AFB, Ohio.
CORRELATION ON NOISY IMAGES
James A. Shine and Eugene A. Margerum Jun. 1980 56 p refs
(DA Proj. 4A1-61102-B-52C)
(AD-A088659; ETL-0230) Avail: NTIS HC A04/MF A01 CSCL 09/2

A computer program can simulate star-shaped images and a correlation between two different images on 128 by 128 matrices. The Fourier transform, in a timesaving algorithm, is used to carry out the correlation. Different factors in the image (contrast, noise, size) are varied and the effects are observed. The results showed good correlation except when the contrast was low and the noise was high. Using a filtering function in the correlation process produced good results in improving poor correlation patterns. GRA

N81-10719# Colorado Univ. at Boulder. Dept. of Computer Science.
FLAT: A FORTRAN LANGUAGE AUGMENTATION TOOL
Leon J. Osterweil and Eugene W. Myers, Jr. Jul. 1980 62 p refs
(Grants DAAG29-80-C-0094; NSF MCS-77-02194)
(AD-A089209; CU-CS-179-80; ARO-17124.1-M) Avail: NTIS HC A04/MF A01 CSCL 09/2

This paper describes the motivation, design, implementation, and some preliminary performance characteristics of FLAT, a macro definition capability for creating language enhancers and translators. FLAT enables the user to specify transformations through STREX, a FORTRAN like language, which enables the specification of macros which are then used to interpretively alter incoming programs. FLAT is specially adapted to the processing of FORTRAN programs. This paper shows how it can be used as a deprocedurizer (or flattener), a dialect to dialect translator, a portability and version control aid, and a device for creating language enhancements as sophisticated as new control structures and abstract data types. GRA

N81-10720# Stanford Univ., Calif. Systems Optimization Lab.
MINOS/AUGMENTED USER'S MANUAL
Bruce A. Murtagh (Univ. of New South Wales, Australia) and Michael A. Saunders Jun. 1980 57 p refs
(Contracts DAAG29-79-C-0110; N00014-75-C-0267; DE-AC03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-79-26009; NSF ENG-77-06761)
(AD-A089351; SU-SOL-80-4) Avail: NTIS HC A04/MF A01 CSCL 12/2

The scope of this manual is restricted to matters additional to those covered in the MINOS User's Guide (2). We assume that you are either already familiar with that manual, or at least have a copy at hand to refer to. Unless nonlinearities are specified, MINOS/AUGMENTED solves the standard linear programming problem, using a reliable implementation of the revised simplex method. (A sparse LU factorization of the basis matrix is computed using the 'bump and spike' algorithm of Hellerman and Rarick, and this is updated in a stable manner by the method of Bartels and Golub. GRA

N81-10721# Massachusetts Univ., Amherst. Dept. of Computer and Information Science.

EDGE RELAXATION AND BOUNDARY CONTINUITY
Allen R. Hanson, Edward M. Riseman, and Frank C. Glazer May 1980 113 p refs
(Contracts N00014-75-C-0459; NSF MCS-79-18209)
(AD-A089173; COINS-TR-80-11) Avail: NTIS HC A06/MF A01 CSCL 05/8

Many image analysis tasks require the construction of a boundary representation as a means of partitioning an image. This paper develops a parallel relaxation algorithm for updating initial heuristic estimates of the likelihood of edges so that continuous boundaries are formed. Bayesian probability theory is used to analyze the probability updating of a single edge based upon the joint probabilities of the edges in its local surrounding context. The relationships between edges, sometimes referred to as compatibility coefficients in relaxation algorithms, are embodied as conditional probabilities between the central edge and the context of edges. The set of conditional probabilities is theoretically derived from a model of desired line drawings that satisfy basic notions of boundary continuity. The local updating function attempts to drive the likelihood of each central edge into consistency with the surrounding context. Experiments involving the iterative parallel application of this nonlinear Bayesian updating function to all edge probabilities demonstrates serious problems in the formulation. A variety of heuristic modifications, guided by theoretical considerations, are examined empirically. The final formulation is an algorithm that performs in an effective manner on several very complex images. GRA

N81-10722# Stanford Univ., Calif. Dept. of Operations Research.
THE STAIRCASE AND RELATED STRUCTURES IN INTEGER PROGRAMMING
Lynne J. Pollenz Jun. 1980 113 p refs
(Contract N00014-76-C-0418; Grant NSF MCS-76-81259)
(AD-A089542; TR-94; TR-80-13) Avail: NTIS HC A06/MF A01 CSCL 12/2

With the advent of the computer age, linear programming has become a major tool for practical problem solving. Integer programming applications are also widespread, but unfortunately no integer programming solution method has been as successful as the simplex method for linear programming. However, it is often possible to improve considerably on computation time by exploiting the special structure of a problem. One common special structure, the staircase structure, occurs frequently in multitime period models. GRA

N81-10723# Stanford Univ., Calif. Dept. of Operations Research.
A COMPUTER PROGRAM FOR THE STAIRCASE INTEGER PROGRAMMING PROBLEM
Lynne J. Pollenz Jul. 1980 66 p refs
(Contract N00014-76-C-0418; Grant NSF MCS-76-81259; NR Proj. 047-061)
(AD-A089543; SU-TR-95) Avail: NTIS HC A04/MF A01 CSCL 12/2

The computer code SDA to be described in this report solves the staircase integer linear programming problem. This formulation arises in multiplant production allocation problems, multisector economic planning models, and multitime period production and inventory problems. The solution method used by the program SDA relies upon decomposition of the problem (SP) into smaller subproblems (St), each of which can then be efficiently solved by an LP-based branch and bound routine. GRA

N81-10724# Stanford Univ., Calif. Dept. of Operations Research.
AN ACCELERATED COVERING RELAXATION ALGORITHM FOR SOLVING 0-1 POSITIVE POLYNOMIAL PROGRAMS
Daniel Granot, Frieda Granot, and Willem Vaessen Jun. 1980 27 p refs
(Contract N00014-76-C-0418; Grant NSF MCS-76-81259; NR Proj. 047-061)
(AD-A089620; TR-93; TR-30-10) Avail: NTIS HC A03/MF A01 CSCL 12/1

The purpose of this paper is to present an accelerated algorithm for solving 0-1 positive polynomial PP problems of finding a 0-1 vector x that maximizes covering constraints. However by contrast with other cutting plane methods in integer programming including our original method, we do not solve the relaxed problems to optimality after the introduction of the cutting-plane constraints. Rather, we first solve each relaxed set-covering problem heuristically and only if the heuristic solution is feasible for PP do we solve the relaxed problem to optimality. The promise of such an approach stems from the excellent performance of the various heuristic algorithms for solving integer programs. Indeed the extensive computational experimentation we performed reveals that the accelerated approach has reduced significantly both the number of covering problems solved to optimality and the computational time required to solve a PP problem. For example the average computational time required to solve a PP problem with 40 variables and an average of 10.5 terms per constraints and 3 variables per term was reduced using the accelerated method from 84.7 to 25.8 seconds while the average number of covering problems solved to optimality was reduced from 11.5 to 3.8. GRA

N81-10725# Naval Research Lab., Washington, D. C. Inorganic and Electrochemistry Branch.
A SCALING AND PLOTTING ROUTINE FOR TWO DIMENSIONAL DATA Interim Report
Terry R. ONeal 30 Sep. 1980 34 p refs
(RR00240341)
(AD-A089673; NRL-MR-4351) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report provides a general plotting routine to express x, y type tabular data in a 2 dimensional graphical form. The program contains a scaling routine to maximize plot coverage and calculate axis length and tick marks. The routines are written in FORTRAN IV computer language and designed to run on a Hewlett-Packard HP 1000 computer system with Graphics 1000 plotting software and a graphics terminal or plotter. GRA

N81-10726# University of Southern California, Marina del Rey. Information Sciences Inst.
GRAPHICS LANGUAGE, VERSION 2.1
Richard Bisbey, II, Dennis Hollingworth, and Benjamin Britt Jul. 1980 82 p
(Contract DAHC15-72-C-0308; ARPA Order-2223)
(AD-A089616; ISI/TM-80-18-Rev-2.1) Avail: NTIS HC A05/MF A01 CSCL 09/2

This document defines the language interface to Version 2.1 of a device independent graphs system intended to facilitate the use of graphics in the command and control environment. The system homogeneously supports graphics terminals of widely varying capability, configured with one or more different programs running on separate computers connected via a C2 communications network. These include both calligraphic and bit map displays as well as plotters. The set of graphics primitives defined here provides a core upon which device independent application tailored graphics packages can be built. Advanced graphics features such as color, shading, and input from multiple devices are supported in a manner that permits use of the same application program with devices not supporting those features. The graphics system performs the appropriate feature mapping to support the connected display device. For example, an application program may specify the color of a line segment. The system maps the specified color into some suitable color supported by the device or in the case of a monochromatic display--into the single color of that device. An enquiry capability is also provided, permitting the application program to determine the characteristics of the connected display device and fully exploit all of its capabilities. GRA

N81-10727# IIT Research Inst., Rome, N.Y.
DATA AND ANALYSIS CENTER FOR SOFTWARE Interim Report, Aug. 1978 - Feb. 1980
Lorraine M. Duvall, Shirley A. Gloss-Soler, and Jon Martens Jun. 1980 92 p refs
(Contract F30602-78-C-0255; AF Proj. 2528)
(AD-A089678; RADC-TR-80-204) Avail: NTIS HC A05/MF A01 CSCL 09/2

The Data and Analysis Center for Software (DACS) is being established to serve as a central source for information and data on software technology. This interim report presents the status of the DACS after the initial 18 months of development. Descriptions of the software engineering computer data base

and the technology information base are provided. This report also contains information on the types of products developed during this reporting period and the upper and lower bounds for mean and variance of the PEXE. These new expressions for finite sample sizes are compared with known asynptotic results. GRA

N81-10728# Maryland Univ., College Park. Dept. of Computer Science.
THE DIRECT LISP APPROACH TO FUNCTION ENVIRONMENT MANIPULATION
Richard J. Wood Jun. 1980 17 p refs
(Contract N00014-76-C-0477)
(AD-A089671; TR-907) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper reviews some of the control structures that have become popular in new extensions to LISP-based programming languages. A method for constructing these complex control structures that employs LISP features without the cost of double evaluation is developed. This technique, called the direct LISP approach, uses the LISP functions FUNCTION and EVAL to maintain and manipulate function access environments. Control environment manipulation is accomplished using continuation pointers and lambda expressions. This approach factors function execution into two distinct steps. First the function is associated with an environment and then it is invoked. The normal LISP evaluation routines retrieve the associated environments and apply the function. This method allows the programmer flexibility to design complex control structures without expensive overhead costs. Several examples that employ the direct LISP approach are presented and discussed. GRA

N81-10729# European Space Agency, Paris (France).
NONLINEAR PROGRAMMING. FOUNDATIONS, TECHNIQUES, EXAMPLES
Dieter Kraft Feb. 1980 146 p refs Transl. into ENGLISH of "Nichtlineare Programmierung - Grundlagen, Verfahren, Beispiele", Rept. DLR-FB-77-68 DFVLR, Oberpfaffenhofen, West Germany, Mar. 1978 Original report in GERMAN previously announced as N79-30980 Original German Report available from DFVLR, Cologne DM 47,30
(ESA-TT-572; DLR-FB-77-68) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 47,30

Methods of nonlinear programming are compared and a synopsis is given of necessary and sufficient conditions for optimal solutions. The coherence of the algorithms is emphasized, and their differences (e.g., determination of search direction) are exposed. Some of the most efficient techniques are compared on the basis of two standard test examples taken from the mathematical programming literature. The computation of optimal control functions for a high performance aircraft by a computer program, in which generalized penalty functions are implemented, is given as an example for the solution of complex realistic problems. The FORTRAN implementation of the generalized penalty function algorithm is presented in an appendix. Author (ESA)

N81-10730# Sigma Data Computing Corp., Washington, D.C. Information and Scientific Applications Div.
UPGRADE USER'S MANUAL FOR USE WITH UPGRADE VERSION 4.0
Laurance J. Milask, Carol Gevecker Graves, and Mark L. Feldman Jan. 1980 97 p refs Sponsored by Council on Environmental Quality
(PB80-191331; EPA/DF-80/006A) Avail: NTIS HC A05/MF A01 CSCL 05B

UPGRADE is a general graphic and statistical analysis system for use with numeric data bases. It operates in an interactive conversational mode, employing English language prompts and responses. The system was used as an analytic tool in various federal studies of environmental and health data. UPGRADE analytical capabilities include interactive xy axis plots, histograms, coordinate maps, statistical analysis via an interface with the statistical analysis system, and numerous data manipulation and summarization routines. GRA

N81-10731# Federal Compiler Testing Center, Washington, D.C.
TEXAS INSTRUMENTS, INC., DX10 COBOL, RELEASE 3.2, INDEXED I-O MODULE
1 Feb. 1980 14 p
(PB80-200280; FCTC/TR-80/01) Avail: NTIS HC A02/MF A01 CSCL 09B

The results of running the Indexed I-O programs of the COBOL Compiler Validation System (CCVS74) against DX10 COBOL were evaluated. These programs were run in conjunction with the testing of the DX10 COBOL compiler for its compliance to the low intermediate level of Federal Standard COBOL. The Indexed I-O module is an extension to the low intermediate level. The technical report provides a description of the evaluation environment and a summary of Indexed I-O language elements together with any errors/deviations found as a result of the evaluation. GRA

N81-10941# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
SOME REMARKS ON POST-FLIGHT ANALYSIS OF SOUNDING ROCKETS
G. Schneiders, H. J. Kramer, A. Craubner, and W. Zeigltrum *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 177-181 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N81-10732 Washington Univ., St. Louis, Mo.
DESIGN DIRECTED PROGRAM IMPROVEMENTS Ph.D. Thesis
Christina Louise Jette 1980 151 p refs
Avail: Univ. Microfilms Order No. 8026251

The design directed program improvement method, an approach to automating source-to-source program improvements is described. It is unique in that it more closely approximates the way optimizations are performed by programmers. It investigates how one automates certain well-defined optimization strategies, program improvements which depend on control and data structure knowledge, access routines, and the like. The automation of such strategies is developed to satisfy several objectives. In particular, techniques are developed to (1) specify improvements at a level abstract enough to apply to a wide variety of implementations without a lot of user interaction, and (2) utilize the goal-oriented nature of such strategies to derive improved versions more directly. These objectives are met, in the main, by viewing this work as a variation of a (design directed) program synthesis problem. A system has been designed and partially implemented to satisfy these objectives. Several detailed examples are used to introduce and motivate both the analytical and synthetic aspects of the system. Symbolic evaluation is used as a primary source of information about a program's behavior. Dissert. Abstr.

N81-10733 Rochester Univ., N. Y.
PERFORMANCE EVALUATION OF COMMUNICATING PROCESSES Ph.D. Thesis
Ilya Gertner 1980 173 p
Avail: Univ. Microfilms Order No. 8023925

A method for the evaluation of communicating processes based upon a finite state machine model is described. The performance evaluator describes a finite state machine that represents a particular abstraction, the system of interest. Different finite state machines may be formulated and applied to the same measurement data to extract different kinds of information. A performance monitoring system was implemented to analyze RIG, a message based distributed operating system. Elementary finite state machines describe the behavior of a single process representing a sequential program. Composite finite states machines describe a group of communicating processes representing a parallel program. To reduce the number of states in the composite model, three transitions are introduced: the first characterizes a long sequence of messages; the second describes the overall system state as a vector of process states; and the third describes a limited number of messages in a stream--a

user view of computations in the system. Then, for the performance evaluation the goal is to find a small number of system states that occur often in the execution of the system and are of significant duration. Dissert. Abstr.

N81-10734 Rochester Univ., N. Y.
UNIFORM INTERFACES FOR DISTURBED SYSTEMS Ph.D. Thesis
Keith Allen Lantiz 1980 234 p
Avail: Univ. Microfilms Order No. 8023933

Certain mechanisms and paradigms for building distributed systems with uniform interfaces are presented. Building on a base of processes communicating solely via messages, four key contributions to research in distributed systems are described. Virtual terminals are presented as the means for managing a large number of application programs per user. The virtual terminal management system provides extensive facilities for editing text, the ability to save all output in disk based data structures, and sophisticated mechanisms for the management of screen space. Principles of command interaction are outlined which facilitate the use of distributed resources. Mechanisms for resource management are presented which are well suited to a distributed environment. Paradigms are presented for how processes should be written and communicated. Of particular importance are the simple yet powerful mechanisms for error and exceptional conditional handling. Dissert. Abstr.

N81-10735 Missouri Univ. - Columbia.
FILE ALLOCATION FOR DISTRIBUTED COMPUTER COMMUNICATION NETWORKS Ph.D. Thesis
Laurence Joseph Laning 1979 264 p
Avail: Univ. Microfilms Order No. 8024382

Methods to allocate file copies of multiple distinct files within a distributed computer communication network are discussed. The developed file allocation algorithm allows the evaluation of networks using adaptive routing techniques. Previous algorithms assume fixed path routing techniques. The problem formulation provides for network performance constraints of average delay by message class, which allows strict control and monitoring of delay performance. The solution methodology is recursive in that it integrates a mathematical programming formulation with a discrete event simulator. This integration obtains results not possible from either method alone. Heuristic rules are developed to resolve any message class delay infeasibilities by altering file placements. These rules use analytical methods to obtain surrogate simulation results so that only a small number of file placements require evaluation by computer simulation. Dissert. Abstr.

N81-10736# Naval Postgraduate School, Monterey, Calif.
DESIRABLE PROPERTIES OF A NETWORK TAXONOMY
Earl E. McCoy and Bernard J. Carey May 1980 45 p refs
(AD-A089293; NPS52-80-007) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper reviews and analyzes the desirable properties of a computer network taxonomy from the point of view of its usefulness in a design procedure. A key factor that must be considered is that the design environment currently evolving uses functionally high level VLSI based building blocks to construct various network architectures. This paper begins by reviewing the uses of a taxonomy in a network context, and continues with a review of specifications for network requirements. A set of hardware interconnection primitives is defined next. A review of the Anderson and Jensen taxonomy (Ander75) is then presented, with a discussion of its completeness. The main thrust of this article is given in a section of attributes of a design oriented taxonomy. Finally, extensions are proposed for fault tolerant considerations and protocols. A computer network is defined to be a hetrogeneous collection of computers and the telecommunications subsystem linking them together. Here the properties of the various network architectures are of particular interest; the 'user' computers (or processors) are considered as sources and sinks of messages being transmitted over the network. No distinction as to the geographical scope of the network is made because it does not impact the taxonomy considerations addressed here. GRA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N81-10737 Minnesota Univ., Minneapolis.
CONSERVATISM WITH ROBUSTNESS TESTS FOR LINEAR FEEDBACK CONTROL SYSTEMS Ph.D. Thesis
Michael Francis Barrett 1980 181 p
Avail: Univ. Microfilms Order No. 8025419

A comprehensive study of techniques for measuring stability robustness of linear multivariable feedback control systems to model uncertainty in the open-loop plant is reported. The class of plant uncertainty considered is that which can be represented as an additive or multiplicative dynamic perturbation to the nominal plant transfer function matrix. It is shown that the stability robustness problem for linear systems can be reduced to that of verifying a certain nonsingularity condition involving the nominal system's return difference matrix and the perturbation. The objective in robustness testing is to devise a practical means for verifying this nonsingularity condition which exploits available information about the uncertainty. Two fundamental mathematical techniques--induced matrix norms and measures--form the basis for all robustness testing concepts examined. A hierarchy of tests based on norms, measures, and eigenvalues is identified which demands more and more information about the uncertainty. Because these tests are sufficient, but not necessary, for stability, they may be conservative. The relationship between tests is used to establish bounds on their conservatism. It is shown that equivalence transformations, in principle, provide the necessary degrees of freedom to eliminate much of the conservatism associated with such tests. Dissert. Abstr.

N81-10738# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
STABILITY AND CONVERGENCE OF ADAPTIVE CONTROL ALGORITHMS. A SURVEY AND SOME NEW RESULTS Interim Report
Lena S. Valavani May 1980 14 p refs
(Grant AF-AFOSR-328177; AF Proj. 2304)
(AD-A089427; LIDS-P-989; AFOSR-80-0778TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Although adaptive controllers have been designed for a number of years, the central question of global asymptotic stability of the overall feedback adaptive loop and its associated error equations remained open until recently. The two main approaches used to design controllers from a stability viewpoint - Lyapunov's Direct Method and Popov's Hyperstability Theory - only assure boundedness of the (augmented) state and parameter errors. The difficulties encountered in both approaches are analyzed and shown to be exactly analogous. Subsequently, a generic model for an adaptive controller is proposed from which already existing adaptive algorithms can be derived with minor modifications. The model unifies various algorithms, under the essential requirement for positive reality of the associated error transfer function, and its proof of stability contains others suggested to date as special cases. Finally some general comments are made regarding rates of convergence, performance of the algorithms in the presence of disturbances and unmodeled dynamics, ease of implementation, etc. GRA

N81-10739# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
PROCEEDINGS OF THE FIRST MEETING OF THE SPECIAL INTEREST GROUP ON CONTROL THEORY Meeting held at Aberdeen, Md., 22 May 1980
Herbert E. Cohen May 1980 127 p refs
(DA Proj. 1R6-65706-M-541)
(AD-A089314) Avail: NTIS HC A06/MF A01 CSCL 12/1

Partial contents: Research for US Army Advanced GC System; Sub-Optimal State Estimation as Related to Predictive Fire Control System Design; Detection and Initiation of Firing Command for an Acceleration Predictor Fire Control System Engaging Maneuvering Targets; Hybrid Computer Simulation of Combat Tank Driven Reticle Fire Control; Robust Autoregressive Models for Predicting Aircraft Motion from Noisy Data; A Design Methodology for

Estimators and Predictors in Fire Control Systems; An Adaptive Lead Prediction Algorithm for Maneuvering Target Engagement; and Application of Delay Feedback in Control System Design.
GRA

N81-10740# Stanford Univ., Calif. Dept. of Operations Research.
TABLES OF QUEUE SIZE AND WAITING TIME DISTRIBUTIONS FOR M/M/C, M/D/C, AND D/M/C QUEUEING SYSTEMS
David M. Avis, Larry A. Edison, Lawrence D. Fossett, Frederick S. Hillier, Martin I. Reiman, and Oliver S. Yu Mar. 1980 96 p refs
(Contract N00014-76-C-0418; Grant NSF ENG-75-14847; NR Proj. 047-061)
(AD-A089540; TR-90; TR-57) Avail: NTIS HC A05/MF A01 CSCL 12/2

This report provides a relatively comprehensive set of tables describing the steady-state behavior of M/M/C, M/D/C, and D/M/C queueing systems. The results given are the probability distribution of the number of customers in the system including those being served and of the waiting time of individual customers in the queue excluding service time, as well as the expected number of customers in the queue excluding those being served. The cases considered are for F sub m/M/c. Also included for comparative purposes are the corresponding results for two related cases, D/E2/2 and M/E2/2. These data represent one portion of the output from a large-scale project of theoretical research, algorithmic development, and computational effort to generate the obtainable numerical results for various classes of GI/G/C systems.
GRA

N81-10741# Stanford Univ., Calif. Dept. of Operations Research.
TABLES OF QUEUE SIZE DISTRIBUTION FOR QUEUEING SYSTEMS WITH ERLANG INTERARRIVAL TIMES
David M. Avis, Larry A. Edison, Lawrence D. Fossett, Frederick S. Hillier, Martin I. Reiman, and Oliver S. Yu Mar. 1980 113 p refs
(Contract N00014-76-C-0418; Grant NSF ENG-75-14847; NR Proj. 047-061)
(AD-A089541; TR-91; TR-58) Avail: NTIS HC A06/MF A01 CSCL 12/2

This report provides a relatively comprehensive set of tables describing the steady-state behavior of certain basic types of queueing systems having an Erlang distribution for the interarrival times.
GRA

N81-10742# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
APPROXIMATION SCHEMES FOR NONLINEAR NEUTRAL OPTIMAL CONTROL SYSTEMS
Karl Kunisch 7 May 1980 55 p refs
(Contract DAAG29-79-C-0161; Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A089684; AFOSR-80-0925) Avail: NTIS HC A04/MF A01 CSCL 12/1

We discuss methods of approximating stable neutral functional differential equations and associated optimal control problems by sequences of optimal control problems for ordinary differential equations. By introducing a class of 'mollified' neutral func. differential equations, convergence of the linear interpolating spline and the averaging approximation scheme is proved. A number of numerical examples is included.
GRA

N81-10743# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
APPLICATIONS OF OPTIMUM CONTROL IN COMMUNICATION NETWORKS [APPLICATION DE LA COMMANDE OPTIMALE DANS LES RESEAUX DE COMMUNICATIONS]
Alain Bousquet and Louis-Francois Pau Jan. 1980 49 p refs In FRENCH
(ENST-D-80001) Avail: NTIS HC A03/MF A01

The different types of control that can be carried out on the elements of a communication network are recalled. The decentralization problem is then examined in a general way together with its possible applications. The generalized reduced gradient algorithm is particularly well suited to providing numerical solutions to the particular problem posed (queues with priorities under transient conditions and subject to various constraints). The practical realization of such a system is discussed.
Author (ESA)

N81-10744# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
STRUCTURAL RECOGNITION OF MANUSCRIPT CHARACTERS [RECONNAISSANCE STRUCTURELLE DE CARACTERES MANUSCRITS]
Quan Nam Huyn May 1979 173 p In FRENCH
(ENST-H-79004) Avail: NTIS HC A08/MF A01

The simulation program was written in FORTRAN. It was tested on a reference base composed of figures obtained from the Munson base, containing 100 figures of each class. The method generates two levels of graph from which cavities are extracted. Further measurements are made as the decision graph is traced. The binary matrices of the base have a resolution of 24 x 24. On an Iris 80 computer, the machine processing time per character was 0.3 sec. A 3.5% error level was obtained. The reject level was 2.5%.
Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-10745 Temple Univ., Philadelphia, Pa.
INTERPOLATION BY MONOTONE CUBIC SPLINES Ph.D. Thesis
John Buchanan Burns 1980 134 p
Avail: Univ. Microfilms Order No. 8025120

The problem defined is to find a monotone cubic spline that interpolates a given monotone infinite sequence. It is shown that the derivative at the knots of a cubic spline satisfy a finite difference equation of the form p (sub n) + 4p (sub n + 1) + p (sub n + 2) = F (sub n) where the F (sub n) are expressed in terms of the backward differences of the given sequence. Conditions are then found on the F (sub n) that guarantee the existence of a monotone cubic spline which interpolates the given sequence. A monotone sequence is displayed for which there exists no monotone cubic spline that interpolates the sequence.
Dissert. Abstr.

N81-10746 Washington Univ., St. Louis, Mo.
INTERVAL GRAPHS, CHRONOLOGICAL ORDERINGS, AND RELATED MATTERS Ph.D. Thesis
Dale John Skrien 1980 131 p
Avail: Univ. Microfilms Order No. 8026309

If a finite, undirected graph is the intersection graph of a set of intervals of the line, it is called an interval graph and the set of intervals is called a representation of the graph. Let I(G) be the set of all representations of an interval graph G in which all of the endpoints of the intervals are distinct. The set I(G) is divided into a finite number of equivalence classes, called chronological orderings of G, which correspond to the possible relative positions of the intervals in representations of the graph. Consideration of these classes leads to new characterizations of interval graphs, and to algorithms, with worst-case time-complexity O(n3) where n is the number of vertices of the graph, for solving problems concerning special representations of interval graphs. Such problems include determining whether a graph has a representation in which certain intervals are properly contained in (extend to the left or right of, are completely to the left or right of) others, and determining whether a graph has a representation in which certain intervals contain given points of the line.
Dissert. Abstr.

N81-10747 Stanford Univ., Calif.
A CONSTRUCTIVE, CONTINUOUS SOLUTION TO HILBERTS 17TH PROBLEM, AND OTHER RESULTS IN SEMI-ALGEBRAIC GEOMETRY Ph.D. Thesis
Charles Neal Delzell 1980 84 p
Avail: Univ. Microfilms Order No. 8024640

That there is a continuous solution to Hilbert's 17th problem (concerning sums of squares of rational functions) is proven. It

is arranged that the coefficient of each monomial in each representing homogeneous rational function be a continuous, semi-algebraic (s.a.) function of the coefficients of the given positive semidefinite (psd) form f, and that each rational function be continuous simultaneously in its variables and in the coefficients of f. Here continuity is with respect to the usual interval topology on the given real closed ground field; when the ground field is the field of real numbers, this continuity automatically implies continuity for the computational topology on enrichments of the reals by certain kinds of representations. Thus a procedure is obtained to solve Hilbert's 17th problem constructively over the reals (or over any real closed field with a dense computable subfield). Additional results are given concerning a finiteness theorem for closed s.a. sets and representations of psd quadratic forms in n variables. Dissert. Abstr.

N81-10748 Brandeis Univ., Waltham, Mass.

A CHARACTERISTIC-FREE APPROACH TO SCHUR COMPLEXES AND RESOLUTIONS OF DETERMINANTAL IDEALS Ph.D. Thesis

Kaan Ucoulk Akin 1980 96 p

Avail: Univ. Microfilms Order No. 8024521

A family of characteristic-free functors from maps of free modules to chain complexes over a commutative ring, called Schur complexes, is introduced. The universality of these functors is proved, their basic properties are examined, and their applications to resolutions of determinantal ideals are investigated. In particular, universal minimal free resolutions are constructed for the ideal of submaximal minors and for the powers of the ideal of maximal minors of generic matrix. Dissert. Abstr.

N81-10749 California Univ., Riverside.

TWO SPECTRAL PROBLEMS FOR OPERATORS GENERATING DIFFERENTIAL EQUATIONS Ph.D. Thesis

David Mills Terlinden 1980 72 p

Avail: Univ. Microfilms Order No. 8025003

Two results in spectral theory motivated by the study of semigroups are presented. The nature of sigma (A + B) is determined, where A generates a quasinilpotent semigroup, the norms of whose members satisfy a growth condition always met by nilpotent semigroups, B is a bounded linear operator with finite dimensional range, and sigma denotes 'spectrum'. Under the conditions of the theorem, either sigma (A + B) = an empty set or sigma (A + B) consists of an unbounded set of isolated points, all of which are eigenvalues. Dissert. Abstr.

N81-10750 Missouri Univ. - Columbia.

LINEAR MULTISTEP METHODS WITH NEAR-OPTIMAL STABILITY Ph.D. Thesis

David Jerome Nolting 1980 109 p

Avail: Univ. Microfilms Order No. 8024385

Desirable properties of linear multistep methods (LMM) were optimized by viewing those properties as functional values and the LMM possessing those properties as points in a domain space. Two such optimizations were conducted numerically. The first was a search for relatively stable explicit LMM and the second was a search for stiffly stable implicit LMM. Near-optimally relatively stable explicit LMM were found for orders four through nine. In the second study the concept of A(alpha, r)-stability was introduced for stiffly stable LMM. It recognized the need for large regions of absolute stability in the left half plane and the need for a region of accuracy about the origin defined by the region of relative stability. An economical means of determining the region of relative stability was developed and used. Nearly-optimal A(alpha,r)-stable implicit LMM were found for orders four through six for a variety of classes determined by fixed constants. Dissert. Abstr.

N81-10751# California Univ., Berkeley. Electronics Research Lab.

ACCURATE COMPUTATION OF DIVIDED DIFFERENCES Ph.D. Thesis

Allan Charles McCurdy 28 May 1980 165 p refs Submitted for publication

(Contract N00014-76-C-0013)

(AD-A088751; UCB/ERL-M80/28) Avail: NTIS HC A08/MF A01 CSCL 12/1

The standard recurrence scheme does not always yield accurate divided differences in finite precision arithmetic. When the function of interest is known analytically and/or its values are easily calculated, methods other than the recurrence scheme can be used. In particular, a table of divided differences can be regarded as a function of a special bidiagonal matrix. Formulas and computational techniques suitable for computing matrix functions may, thus, be exploited for divided differences. Divided difference tables of the exponential function are profitably treated as the exponential of a special matrix. This approach is good precisely when the standard recurrence is bad, namely when the abscissae of the divided differences are close. When the abscissae are scaled down by powers of 2, the resulting scaled divided difference table may be squared to give the wanted tables. For real abscissae this scaling and squaring technique, in combination with the standard recurrence where suitable, yields a hybrid algorithm which permits computation of any exponential divided difference to an accuracy dependent only on the order of the difference. For appropriate arrangements of complex abscissae, such as conjugate pairs, a similar result is established. A good way to compute the exponential of a real square matrix A is to use the Newton divided difference interpolating polynomial. Our algorithm finds an important application in computing accurately the coefficients of this polynomial. GRA

N81-10752# Maryland Univ., College Park. Vision Lab.

ON THE CORRELATION STRUCUTURE OF NEAREST NEIGHBOR RANDOM FILLED MODEL OF IMAGES Interim Report

R. Chellappa Jul. 1980 58 p refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A089413; TR-912; AFOSR-80-0945TR) Avail: NTIS HC A04/MF A01 CSCL 05/8

This paper discusses the correlation structure of some two-dimensional nearest neighbor random field models of images. The correlation structure of two nonequivalent random field models, the so-called simultaneous model and the conditional Markov model, are analyzed in continuous as well as discrete space. Analyses of two-dimensional moving average models and autoregressive and moving average models are also included. Based on the structure of the correlation function at lower lags an empirical test is suggested for the inference of image models. Examples from real textures are given. GRA

N81-10753# Geodetic Services, Inc., Indialantic, Fla.

SEQUENTIAL ARRAY ALGEBRA USING DIRECT SOLUTION OF EIGENVECTORS Scientific Report, 1 Oct. 1979 - 1 Apr. 1980

Urho A. Rauhala Jun. 1980 11 p refs

(Contract DMA700-78-C-0022)

(AD-A088851) Avail: NTIS HC A02/MF A01 CSCL 12/1

A least squares solution of sequential array algebra observation equations is derived using spectral decomposition of the normal equation matrix in terms of array algebra. A new direct solution for computation of eigenvectors is derived using the theory of general matrix inverses. GRA

N81-10754# Wisconsin Univ. - Madison. Mathematics Research Center.

LOCAL PIECEWISE POLYNOMIAL PROJECTION METHODS FOR AN ODE WHICH GIVE HIGH-ORDER CONVERGENCE AT KNOTS Summary Report

Carl deBoor and Blair Swartz May 1980 22 p refs

(Contract DAAG29-80-C-0041; DAAG29-75-C-0024; W-7405-eng-36)

(AD-A089589; MRC-TSR-2072) Avail: NTIS HC A02/MF A01 CSCL 12/1

Local projection methods which yield C(m-1) piecewise polynomials of order m-k as approximate solutions of a boundary value problem for an m(th) order ordinary differential equation are determined by the k linear functionals at which the residual error in each partition interval is required to vanish. We develop a condition on these k functionals which implies breakpoint superconvergence (of derivatives of order less than m) for the approximating piecewise polynomials. The same order of super-convergence is associated with eigenvalue problems. GRA

N81-10755# Wisconsin Univ. - Madison. Mathematics Research Center.

THEORETICAL AND PRACTICAL ASPECTS OF SINGULARITY AND EIGENMODE EXPANSION METHODS
Summary Report
A. G. Ramm Mar. 1980 21 p refs
(Contracts DAAG29-75-C-0024; F49620-79-C-0128)
(AD-A089588; MRC-TSR-2051) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Foundations of singularlity and eigenmode expansion methods and some practical questions related to the theory are discussed. GRA

N81-10756# Wisconsin Univ. - Madison. Mathematics Research Center.
LARGE AMPLITUDE FOR TWO COMPETING SPECIES
Summary Report
Robert A. Gardner Jun. 1980 36 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A089663; MRC-TSR-2090) Avail: NTIS
HC A03/MF A01 CSCL 06/3

Large amplitude solutions are obtained for systems of semilinear reaction-diffusion equations arising in mathematical ecology which describe the evolution of two competing species. Their behavior is locally consistent with the principle of competitive exclusion. Such solutions are first obtained for a special class of steady state equations in which the two species are assumed to be exactly equal competitors; large amplitude patterns for generic classes of equations are then obtained by introducing various perturbations in the relative competitive strengths of the two species. In particular, we obtain (1), travelling wave solutions through constant perturbations, and (2), stable stationary solutions through spatially inhomogeneous perturbations. GRA

N81-10757# Wisconsin Univ. - Madison. Mathematics Research Center.
A COUNTEREXAMPLE FOR THE TROTTER PRODUCT FORMULA
Thomas G. Kurtz and Michel Pierre Jun. 1980 14 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A089664; MRC-TSR-2091) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This report describes linear m-accretive operators A sub 1 and A sub 2 whose sum is m-accretive but for which the associated product formulas do not converge. GRA

N81-10758# Wisconsin Univ. - Madison. Mathematics Research Center.
ON THE GENERALIZED EULER-FROBENIUS POLYNOMIAL
Summary Report
Y. Y. Feng and J. Kozak Jun. 1980 17 p refs
(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024)
(AD-A089661; MRC-TSR-2088) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In this paper the properties of the generalized Euler-Frobenius polynomial are studied. It is proved that its zeroes are separated by a factor q and their asymptotic behavior as Q approaches infinity is obtained. As a consequence it is shown that least squares spline approximation on a biinfinite geometric mesh is boundable independently of the (local) mesh ratio q and that the norm of the inverse of the corresponding B-spline Gram matrix decreases monotonly to 2k - 1 for large q, as Q approaches infinity. GRA

N81-10759# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
BIASED ESTIMATION IN REGRESSION Final Report, 1 Jul. 1979 - 30 Jun. 1980
Richard F. Gunst Aug. 1980 12 p refs
(Contract F49620-79-C-0106; AF Proj. 2304)
(AD-A089576; AFOSR-TR-80-0865) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Summarized in the report are four scholarly papers that have been published during the contract period and four other articles which are in various stages of submission for publication. Several other activities directly connected with this research are briefly discussed. A list of all research articles published since the commencement of the contract concludes the report. GRA

N81-10760# Brown Univ., Providence, R. I.
AN APPROXIMATION SCHEME FOR DELAY EQUATIONS
Franz Kappel 16 Jun. 1980 20 p refs
(Contract DAAG29-79-C-0161; Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A089655; AFOSR-80-0924TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

We present a general approximation scheme for autonomous FDE's with Lipschitzean right hand side. Our approach is based on approximation results in semigroup theory. The results are applied to nonlinear autonomous FDE's in the state space IR to the nth power x L to the 2nd power and to linear autonomous FDE's of neutral type in the state spaces IR to the nth power x L to the 2nd power and W to the 2nd power. GRA

N81-10761# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
PARAMETRIC MODELING OF LINEAR AND NONLINEAR SYSTEMS Ph.D. Thesis
Francis Anthony Perry Jun. 1980 287 p refs
(AD-A089501) Avail: NTIS HC A13/MF A01 CSCL 12/1

The problem of obtaining parametric models for linear and nonlinear systems based on observations of the input and output of the system is one of wide ranging interest. For linear systems, moving average (MA) and autoregressive (AR) models have received considerable attention and, based on the Levinson algorithm, a number of very powerful methods involving lattice filter structures have been developed to obtain the model solutions. For nonlinear systems the Volterra series model which is a nonlinear extension of the moving average model is frequently used. The purpose of this research is to extend these techniques to more general linear and nonlinear models. Using the equation error formulation, lattice solution methods in batch processing and adaptive form are developed for both single and multichannel autoregressive moving average (ARMA) models for linear systems and Volterra series models for nonlinear systems. A nonlinear extension of the ARMA model is also considered and is shown in some cases to remedy problems encountered in Volterra modeling of nonlinear systems. Lattice methods are also developed for the nonlinear ARMA model and it is shown that the methods obtained for linear ARMA modeling follow as a special case of the nonlinear results. GRA

N81-10762# Wisconsin Univ. - Madison. Mathematics Research Center.
CONVERGENCE OF NONLINEAR ELLIPTIC OPERATORS AND APPLICATION TO A QUASI VARIATIONAL INEQUALITY
Maria Giovanna Garroni and Jean-Pierre Gossez May 1980 31 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A089640; MRC-TSR-2083) Avail: NTIS
HC A03/MF A01 CSCL 20/13

Closedness and compactness results are given for a sequence of nonlinear elliptic operators with monotone type assumptions. These results are then used in the second part to derive existence theorems for a quasi variational inequality related to some questions from nonlinear heat flow. This quasi variational inequality involves a second order operator as above and an implicit obstacle of the Signorini type on the boundary. GRA

N81-10763# Wisconsin Univ. - Madison. Mathematics Research Center.
INTEGRATION OF INTERVAL FUNCTIONS Summary Report
Ole Caprani (Copenhagen Univ.), Kaj Madsen (Denmark Technical Univ.), and L. B. Rall Jun. 1980 37 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A089644; MCR-TSR-2087) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Thd lack of a theory of integration of interval functions has hampered the development of interval methods for the solution of integral equations, which constitute an important class of mathematical models of real situations. This report provides such a theory by defining integrals of interval functions to be an interval with the limits of integrals of step functions respectively less and greater than the integrand as endpoints. As these lower and upper Darboux integrals of basic integration theory always

exist, it follows that all interval functions are integrable. The simplicity of this theory is due to the fact that intervals, rather than real numbers only, are accepted as values of integrals, even if the integrand is a real function called a degenerate interval function in this context. Some useful properties of the interval integral defined in this report are derived, and its potential usefulness in connection with the numerical solution of integral equations is indicated. GRA

N81-10764# Wisconsin Univ. - Madison. Mathematics Research Center.

A PSEUDO-PARABOLIC VARIATIONAL INEQUALITY AND STEFAN PROBLEM Summary Report

E. Dibenedetto and R. E. Showalter (Texas Univ., Austin) Aug. 1980 26 p refs

(Contract DAAG29-80-C-0041)

(AD-A089638; MRC-TSR-2100) Avail: NTIS HC A03/MF A01 CSCL 20/13

We study existence and uniqueness questions concerning non-linear variational inequalities. Applications to free boundary problems are also given. GRA

N81-10765# Wisconsin Univ. - Madison. Mathematics Research Center.

REPRESENTATIONS OF INTERVALS AND OPTIMAL ERROR BOUNDS Summary Report

L. B. Rall Jul. 1980 22 p refs

(Contract DAAG29-80-C-0041)

(AD-A089636; MRC-TSR-2098) Avail: NTIS HC A02/MF A01 CSCL 12/1

Calculations with interval arithmetic and interval extensions of real functions are often used to obtain lower and upper bounds for what would be the theoretical results of precise computations on exact data. A more traditional way to represent approximate data and results contained in intervals is by means of a representative point x in the interval and an associated measure of error E. For example, the midpoint of an interval has absolute error as an approximation to other points of the interval which is bounded by half the width of the interval. In general, the chosen point is said to be optimal with respect to the measure of error if the maximum value of E over the interval is minimized. A general method for determination of optimal points x and minimal error bounds E is given. GRA

N81-10766# Wisconsin Univ. - Madison. Mathematics Research Center.

A NONLINEAR HYPERBOLIC VOLTERRA EQUATION IN VISCOELASTICITY

C. M. Dafermos (Brown Univ.) and J. A. Nohel Jun. 1980 35 p refs

(Contract DAAG79-80-C-0041; Grants DAAG27-76-G-0294; NSF MCS-79-05774)

(AD-A089668; MRC-TSR-2095) Avail: NTIS HC A03/MF A01 CSCL 12/1

A general model for the nonlinear motion of a one dimensional, finite, homogeneous, viscoelastic body is developed and analysed by an energy method. It is shown that under physically reasonable conditions the nonlinear boundary, initial value problem has a unique, smooth solution (global in time), provided the given data are sufficiently 'small' and smooth, moreover, the solution and its derivatives of first and second order decay to zero as t yields infinity. Various modifications and generalizations, including two and three dimensional problems, are also discussed. GRA

N81-10767# Wisconsin Univ. - Madison. Mathematics Research Center.

ON A SEMI-COERCIVE QUASI-VARIATIONAL INEQUALITY

Maria Giovanna Garroni and Jean-Pierre Gossez Jun. 1980 12 p refs

(Contract DAAG29-80-C-0041)

(AD-A089665; MRC-TSR-2092) Avail: NTIS HC A02/MF A01 CSCL 20/13

One feature of the so-called quasi-variational problems is that the constraints are not given in advance. The problem considered in this paper is related to the description of a stationary temperature distribution inside a material with thermally semi-permeable boundary (here are the constraints) in the case where the exterior temperature varies proportionally to some average of the heat flux crossing the boundary (here is the dependence of the constraints on the solution). Some existence results were obtained in a previous work by the authors, assuming that the heat balance equation is coercive, a condition which eventually yields solutions for any forcing term. Here we deal with a weakened form of this condition, the semi-coercive case, which, in some respects, is physically more natural. A sufficient and almost necessary condition on the forcing term is obtained for the existence of solutions. GRA

N81-10768# California Univ., Los Angeles. Dept. of Mathematics.

SCHEME-INDEPENDENT STABILITY CRITERIA FOR DIFFERENCE APPROXIMATIONS OF HYPERBOLIC INITIAL-BOUNDARY VALUE PROBLEMS. 2 Interim Report

Moshe Goldberg (Technion-Israel Inst. of Technology, Haifa) and Eitan Tadmor (Tel-Aviv Univ., Israel) Aug. 1980 47 p refs Prepared in cooperation with Tel-Aviv Univ., Israel

(Grants AF-AFOSR-3046-76; AF AFOSR-0127-79; AF-AFOSR-3035-76; AF Proj. 2304)

(AD-A089650; AFOSR-80-0929TR) Avail: NTIS HC A03/MF A01

Convenient stability criteria are obtained for difference approximations to hyperbolic initial-boundary value problems. The approximations consist of arbitrary basic schemes and a wide class of boundary conditions. The new criteria are given in terms of the outlfow part of the boundary conditions and are independent of the basic scheme. The results easily imply that a number of well known boundary treatments, when used in combination with arbitrary stable basic schemes, always maintain stability. Consequently, many special cases studied in recent literature are generalized. GRA

N81-10769# Limoges Univ. (France). Lab. d'Electronique des Microondes.

APPROXIMATION AND SYNTHESIS OF CERTAIN CLASSES OF MICROWAVE FILTERS Final Report [APPROXIMATIONS ET SYNTHESES DE CERTAINES CLASSES DE FILTRES MICROONDES]

Pierre Jarry Apr. 1980 45 p refs In FRENCH

(Contract DGRST-75-7-0696)

(ERA-535) Avail: NTIS HC A03/MF A01

Optimized amplitude and phase transfer functions were defined and studied in order to realize linear phase resonant line filters. A systematic study of linear phase generalized polynomials (Bessel and Jacobi) is presented together with their applications to nonminimum phase transfer functions. A nonreciprocal synthesis method is given. A new class of orthogonal polynomials (intermediate polynomials) is introduced and rigorously studied from the mathematical point of view. Some practical applications of these polynomials are given. Author (ESA)

N81-10770# Woods Hole Oceanographic Institution, Mass.

TIME SERIES ANALYSIS PROGRAMS

Alan D. Chave May 1980 58 p refs

(Grants NSF OCE-77-82255; NSF OCE-79-19258; NSF OCE-77-8633)

(PB80-204829; WHOI-80-23) Avail: NTIS HC A04/MF A01 CSCL 12A

The report documents a set of FORTRAN subroutines for manipulating one dimensional, complex-valued time series information. The programs are divided into two libraries: TSLIB for ordinary Fourier analysis and ACLIB for more specialized applications. The latter includes interpolation routines, maximum entropy spectral analysis programs, and subroutines for advanced mathematical operations. The programs are designed for efficiency and speed with a minimum of hidden operations and memory accesses. These subroutines were used extensively in the analysis of magnetotelluric and other geophysical data. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-10771 University of South Florida, Tampa.

NON PARAMETRIC QUASI-BAYESIAN ESTIMATION OF

RELIABILITY AND PRIOR DISTRIBUTION Ph.D. Thesis
Cheng-Ming Weng 1980 83 p
Avail: Univ. Microfilms Order No. 8022936

Failure models which depend on stochastic parameters whose distribution G(theta) is unknown are examined from a nonparameter point of view and in a Bayesian setting. The problem of estimating G when a priori information about G is specified in the form of an initial guess G(theta) is considered. Assuming that the unconditional failure time distribution is a Dirichlet process, estimators of the priori G and reliability function are obtained based on censored data. Also, assuming that the unconditional failure time distribution is a mixture of Dirichlet process, Bayesian estimators are obtained for reliability and the prior distribution Monte Carlo simulation is employed to compare the estimators for some specific failure models. Dissert. Abstr.

N81-10772 Temple Univ., Philadelphia, Pa.
ROBUST DERIVATIVE ESTIMATION Ph.D. Thesis
Thomas Peter Capizzi 1980 216 p
Avail: Univ. Microfilms Order No. 802122

It is sometimes necessary to obtain an estimate of the derivative of a function from discrete observations on the function. Several robust methods of estimating the derivative of a small number of observations were examined. Derivative estimation was viewed in a regression sense with the estimates being those given by the predicted value of a regression function. Ordinary least squares (OLS) or robust regression (iteratively reweighted least squares) are used on either polynomials or cubic splines. These techniques were investigated assuming that the underlying function had one of three functional forms: an exponential, a sine and a cubic. For all three cases simulated data with normal and nonnormal errors were used and the performance of each method was evaluated using the true mean square error, mean absolute deviation, maximum errors, and percent variation. Least squares splines in which the end conditions were specified in advance appeared to give better estimates in terms of the true mean square error than splines in which the end conditions are not specified. It was found that the cubic spline methods were much better than the cubic polynomials methods in estimating the derivatives for simulated exponential and sine data.
Dissert. Abstr.

N81-10773 Rochester Univ., N. Y.
ESTIMATION OF RELATIVE RISK IN A PROPORTIONAL HAZARDS MODEL Ph.D. Thesis
Janet Marie Regun 1980 167 p
Avail: Univ. Microfilms Order No. 8023911

In both medical and reliability studies, it is frequently of interest to compare the survival times in independent samples from two populations. When the hazard functions corresponding to two populations are proportional, the constant of proportionality--called relative risk--provides a descriptive summary of the survival experience of one population relative to the other. Estimation of both the relative risk and the underlying distribution function of a proportional hazards model is investigated.
Dissert. Abstr.

N81-10774 Pennsylvania State Univ., University Park.
ROBUST ESTIMATES AND TESTS FOR THE ONE-SAMPLE SCALE MODEL WITH APPLICATIONS TO VARIANCE COMPONENT MODELS Ph.D. Thesis
Lewis Howard Shoemaker 1980 164 p
Avail: Univ. Microfilms Order No. 8024494

The scale problem and a class of robust techniques which are useful in estimation and testing were studied. Tests and estimates of dispersion for the one-sample problem were developed. Results from the one-sample case are then extended to testing of equality of two scale parameters in the two-sample problem. Finally, extensions are made for testing and estimation in the one-way random effects model, the two-way random effects model, and the two-way mixed effects model. The classical functional which was used as a measure of variability of a distribution is the standard deviation. Its associated estimator, the sample standard deviation, is shown to have highly undesirable robustness properties. Another measure of variability, the square root of the mid-variance, is proposed and investigated. The mid-variance is basically the asymptotic variance of an M estimator of location and is shown to behave like a winsorized variance. The asymptotic distribution of the sample estimator of the mid-variance is found and a small sample approximation of the distribution using the chi-square distribution is developed. With the above machinery, one-sample and two-sample tests of variability are constructed. Dissert. Abstr.

N81-10775 Boston Univ., Mass.
THE THEORY OF FINITELY ADDITIVE PROBABILITY USING NONSTANDARD ANALYSIS Ph.D. Thesis
Thomas Quinton Sibley 1980 165 p
Avail: Univ. Microfilms Order No. 8024218

A nonstandard representation for all finitely additive (conditional) probability measures which gives the correct value of the (conditional)integrals of all nonnegative functions is given. Many of the results of vague convergence to the finitely additive case are generalized and some important properties of ultrafilterlimits, new and seemingly powerful model theoretic tools are given. Under ultrafilterlimits, the set of all finitely additive probability measures is closed and the countably additive probability measures are dense. Characteristic functions (Fourier-Stieltjes transforms) to the finitely additive case are generalized. Given two finitely additive probability measures with characteristic functions f and g, then f g is the characteristic function of any convolution of these two measures. Under ultrafilterlimits, the set of all characteristic functions is closed and the continuous characteristic functions, corresponding to the countably additive probability measures, are dense. Finitely additive infinitely divisible laws are investigated and related to their characteristic functions using ultrafilterlimits. Dissert. Abstr.

N81-10776 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
CONTINUOUS DENSITY APPROXIMATION ON A BOUNDED INTERVAL USING INFORMATION THEORETIC CONCEPTS Ph.D. Thesis
James Everett Miller, Jr. 1980 261 p
Avail: Univ. Microfilms Order No. 8021666

The theoretical development and numerical implementation of a procedure for approximating continuous probability density functions on a bounded interval are presented. The procedure is based on the solution of a constrained entropy maximization problem and requires information in the form of expected values of information functions. The approach involves three steps: (1) estimation of expected (or average) values of potential information functions; (2) selection of the active subset of functions to define the approximation family, and (3) simultaneous solution of the constraints to select the specific approximating density for a given set of data. A set of potential information functions is developed, and three numerical methods for active set selection are demonstrated. Numerical techniques for expected value computation are discussed, and a scheme for solution of the constraints is developed and implemented. Dissert. Abstr.

N81-10777 Florida State Univ., Tallahassee.
ON DETERMINING THE NUMBER OF PREDICTORS IN A REGRESSION EQUATION USED FOR PREDICTION Ph.D. Thesis
Meg Brady Carr 1980 288 p
Avail: Univ. Microfilms Order No. 8026121

A criterion that will indicate a priori the optimum number of predictors to use in a prediction equation is developed. The mean square error statistics is used to evaluate the performance of a regression equation in both the dependent and independent samples. Selecting the best prediction equation consists of determining the equation with the minimum estimated independent sample mean square error. The approximations and estimators are tested in Monte Carlo simulations to determine their skill in indicating the number of predictors which will yield the best prediction equation. It is found that the better estimators are capable of indicating a number of predictors to include in the regression equation for which the corresponding independent sample mean square error is near the minimum value. As a practical test, the various estimators of the independent sample mean square error are applied to the data used in deriving the Model Output Statistics (MOS) maximum and minimum tempera-

ture forecast equations. One of the estimators is able to determine MOS forecast equations that perform as well as the operational equations. Dissert. Abstr.

N81-10778*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BACKWARD DELETION TO MINIMIZE PREDICTION ERRORS IN MODELS FROM FACTORIAL EXPERIMENTS WITH ZERO TO SIX CENTER POINTS

Arthur G. Holms 14 Aug. 1980 63 p refs Presented at the 140th Annual Meeting of the Am. Statist. Assoc., Houston, Texas, 11-14 Aug. 1980

(NASA-TM-81524; E-475) Avail: NTIS HC A04/MF A01 CSCL 12A

Population model coefficients were chosen to simulate a saturated 2 to the fourth power fixed effects experiment having an unfavorable distribution of relative values. Using random number studies, deletion strategies were compared that were based on the F distribution, on an order statistics distribution of Cochran's, and on a combination of the two. Results of the comparisons and a recommended strategy are given. Author

N81-10779# Stanford Univ., Calif. Dept. of Statistics.

AN ADAPTIVE CHOICE OF THE SCALE PARAMETER FOR M-ESTIMATORS Ph.D. Thesis

Robert Michael Bell Jul. 1980 82 p refs

(Contract DAAG29-79-C-0166)

(AD-A089220; SU-TR-3; ARO-16668.1-M) Avail: NTIS HC A05/MF A01 CSCL 12/1

Let x sub 1 to x sub n be a random sample from a distribution symmetric about the unknown location parameter theta. A major class of robust estimators of location is the class of M-estimators, each of which corresponds to a function psi defined on the reals. To be scale equivariant, these estimators require the use of a scale equivariant function of the sample. Commonly, this scale parameter is chosen to be a constant times the sample MAD (medial absolute deviation from the median). For a given function psi, the variance of the corresponding M-estimator varies considerably with the value of the scale parameter. It is therefore proposed that the value which minimizes an estimate of the asymptotic variance of the M-estimator be used as the scaling factor. This adaptive method of scaling is shown to be asymptotically optimal (under fairly general conditions), in the sense that the resulting M-estimator has the smallest possible asymptotic variance among all M-estimators based on psi. In particular, when the underlying distribution is normal, the adaptive estimator based on any reasonable psi achieves full asymptotic efficiency, i.e., is asymptotically equivalent to the sample mean. The performance of the estimator for small samples is investigated by Monte Carlo methods for several choices of psi using the triefficiency criteria. A slight modification of the above estimator compares favorably with Tukey's bisquare M-estimator for sample sizes as small as 20. GRA

N81-10780# Princeton Univ., N. J. Dept. of Statistics.

DIRECTIONAL DATA ANALYSIS

Geoffrey S. Watson Jul. 1980 25 p refs

(AD-A089155; TR-170-SER-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

The current methods of analyzing directional data were motivated by measurements of (1) the direction of the long axis of pebbles, (2) the direction (not strength) of magnetization of rocks, and (3) the vanishing bearings of homing pigeons. In case (1) we have axial, not directional, data, and the axes could be oriented into two or three dimensions. The data could be displayed by marking the two points where the axis cuts a unit circle or sphere. In case (2), each measurement can be thought of as a unit vector or as a point on a sphere of unit radius. In case 3, each measurement can be thought of as an angle, a point on a circle of unit radius or a unit vector in the plane. In each of these cases, the sample of axes or directions has a fairly symmetric cluster about some mean direction, so that some scalar might be sought to describe the dispersion of the data. E.D.K.

N81-10781# Virginia Polytechnic Inst. and State Univ., Blacksburg.

MARKOVIAN TIME-DELAY SAMPLING POLICIES

Y. V. Hui and D. R. Jensen Aug. 1980 30 p refs

(Grant DAAG29-78-G-0172)

(AD-A089183; RR-Q-5; ARO-15194.6-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

Sampling procedures are considered for monitoring the output of a production process. Sampling rates are allowed to depend on one of several levels of acceptance or rejection, sampling less frequently when the process is in control. The problem is formulated as a simple Markov process whose properties yield the expected values and the variances of the number of samples and the numbers of various types of adjustments to the process. Computations are given in support of the economic design of variable sampling policies of this type. GRA

N81-10782# Wisconsin Univ. - Madison. Mathematics Research Center.

THE DUALITY OF DIAGNOSTIC CHECKING AND ROBUSTIFICATION IN MODEL BUILDING. SOME CONSIDERATIONS AND EXAMPLES

Steven P. Bailey and George E. P. Box Jun. 1980 54 p refs (Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)

(AD-A089643; MRC-TSR-2086) Avail: NTIS HC A04/MF A01 CSCL 12/1

Consideration is given to the means by which appropriate diagnostic checking functions of the data can be developed to guard against feared model discrepancies. A formal basis for the selection of a function is given for situations where the feared inadequacy can be characterized by a discrepancy parameter beta which takes a possible inappropriate value of beta sub zero in the model. The relationship of this checking function with the posterior distribution obtained from an elaborated 'robustified' model which allows for the discrepancy parameter to be estimated is discussed. The nature of the diagnostic check is briefly described for problems relating to transformation of the dependent variable and to serial correlation while a more thorough investigation of the checking function is given for problems relating to outlying observations and to transformation of predictor variables. Several examples are given to illustrate these ideas. GRA

N81-10783# Wisconsin Univ. - Madison. Mathematics Research Center.

MODELING THE NATURE AND FREQUENCY OF OUTLIERS Summary Report

Steven P. Bailey and George E. P. Box May 1980 63 p refs (Contracts DAAG29-80-C-0041; DAAG29-75-C-0024)

(AD-A089642; MRC-TSR-2085) Avail: NTIS HC A04/MF A01 CSCL 12/1

Bayesian techniques are applied to the problem of dealing with the possible occurrence of outlying observations. Since most experimental data are liable to occasional discrepancies, a robustification approach is taken whereby this experimental 'fact of life' is taken into account in the model. Special consideration is given to the way in which both the nature and the frequency of the outlying observations are modeled. In this regard, the Bayesian outlier procedure of Box and Tiao, which assumes a contaminated error distribution with alpha denoting the frequency of contamination, is developed further. In particular, alpha is not assumed to be known, but rather, a prior distribution is used to express uncertainty about its value. When combined with the information about alpha contained in the data itself, it is seen that appropriate inferences about this outlier frequency can be made. A detailed example is presented. Author (GRA)

N81-10784# Wisconsin Univ. - Madison. Mathematics Research Center.

SOME ASPECTS OF MODEL ESTIMATION AND MODEL CRITICISM Summary Report

Steven P. Bailey and George E. P. Box May 1980 52 p refs (Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)

(AD-A089641; MRC-TSR-2084) Avail: NTIS HC A04/MF A01 CSCL 12/1

The recently advanced philosophy of model building is developed further. It is stressed how Bayesian inferences based on the posterior distribution of the model parameters are appropriate only after sampling theory inferences based on the predictive distribution of the data fail to discredit the model. An example involving the normal distribution is discussed in detail.

Diagnostic checking functions are developed which can be applied in an intuitive sequential manner. Careful attention is also given to the nature of the predictive distribution for the extreme situation where information about the parameters is very precise or very vague. For the latter case, it is illustrated how the predictive distribution can simultaneously (I) reflect this vague information in an appropriate manner and (II) allow for the checking of the adequacy of the basic distributional assumptions such as normality and independence. A particular problem in the interpretation of predictive distributions arises in situations involving a discrete data-generating distribution with vague prior knowledge about the parameter's. This problem is explored in depth for the case of the binomial distribution.
Author (GRA)

N81-10785# Wisconsin Univ. - Madison. Mathematics Research Center.
BOUNDS FOR OPTIMAL CONFIDENCE LIMITS FOR SERIES SYSTEMS
Bernard Harris and Andrew P. Soms Jun. 1980 22 p refs
(Contracts N00014-79-C-0321; DAAG29-80-C-0041)
(AD-A089666; MRC-TSR-2093) Avail: NTIS HC A02/MF A01 CSCL 12/1

Lindstrom-Madden type approximations to the lower confidence limit on the reliability of a series system are theoretically justified by extending and simplifying the results of Sudakov (1973). Applications are made to Johns (1976) and Winterbottom (1974). Numerical examples are presented. GRA

N81-10786# Florida State Univ., Tallahassee. Dept. of Statistics.
SMALL SAMPLE PROPERTIES OF TWO SURVIVAL FUNCTION ESTIMATORS BASED ON INCOMPLETE DATA
Yuan-Yan Chen, Myles Hollander, and Naftali A. Langberg Jul. 1980 21 p refs
(Grant AF-AFOSR-3678-78; AF Proj. 2304)
(AD-A089656; FSU-STATISTICS-M550; TR-78-112; AFOSR-80-0931TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

For estimating an underlying survival distribution, we consider two estimators based on a randomly right-censored sample: The traditional Product Limit Estimator (PLE), introduced by Kaplan and Meier (1958), and a competitor, the Piecewise Exponential Estimator (PEXE), introduced by Kitchin, Langberg, and Proschan (1980a). Under a proportional hazards model we present formulas for the mean and variance of the PLE and find upper and lower bounds for mean and variance of the PEXE. These new expressions for finite sample sizes are compared with known asymptotic results. GRA

N81-10787# Florida State Univ., Tallahassee. Dept. of Statistics.
TESTING WHETHER NEW IS BETTER THAN USED WITH RANDOMLY CENSORED DATA Interim Report
Yuan-Yan Chen, Myles Hollander, and Nafatali A. Langberg Jun. 1980 30 p refs
(Grant AF-AFOSR-3678-78; AF Proj. 2304)
(AD-A089687; FSU-STATISTICS-M503; AFOSR-80-0943TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A life distribution F (a distribution function such that $F(x) = 0$ for $x < 0$), with survival function the superior limit of F is approximately 1-F, is new better than used (NBU). The dual notion of a new worse than used (NWU) life distribution function is defined by reversing the inequality. The boundary members of the NBU and NWU classes, obtained by insisting an inequality, are the exponential distribution functions. The NBU class of life distributions is useful in performing analyses of lifelengths. These distribution functions provide readily interpretable models for describing wearout, play a fundamental role in studies of replacement policies and in shock models, and have desirable closure properties. GRA

N81-10788# Florida State Univ., Tallahassee. Dept. of Statistics.
A NEW METHOD FOR ESTIMATING LIFE DISTRIBUTIONS FROM INCOMPLETE DATA Interim Report
John Kitchin, Naftali A. Langberg, and Frank Proschan May 1980 24 p refs
(Grant AF-AFOSR-3678-78; AF Proj. 2304)
(AD-A089685; FSU-STATISTICS-M548; AFOSR-80-0932TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We construct a new estimator for a continuous life distribution from incomplete data, the Piecewise Exponential Estimator (PEXE). We show that the PEXE is strongly consistent under a mild restriction on the distribution of the censoring random variables (possible non-identical and non-continuous). Then we consider the Product Limit Estimator (PLE), introduced by Kaplan and Meier (1958). We prove the strong consistency of the PLE under a mild regularity condition on the distributions of the censoring random variables. This result extends previous ones obtained by various researchers. Finally we compare the new PEXE and traditional PLE. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-10789*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STABILITY BOUNDARIES FOR SYSTEMS WITH FREQUENCY-MODEL FEEDBACK AND COMPLACENCY FILTER
L. Keith Barker Nov. 1980 43 p refs
(NASA-TP-1744; L-13787) Avail: NTIS HC A03/MF A01 CSCL 12B

General parameter-plane equations were derived to generate boundaries for a class of systems characterized by a feedback loop that contains a complementary filter and a model for either the low- or high-frequency portion of the plant. This combination allows those frequencies of the part of the plant that is modeled to be fed back for control while suppressing other frequencies. For all specific examples considered, the stability regions obtained using the complementary filter and frequency model were larger (and in some cases, considerably larger) than those obtained using a low pass filter in the feedback of the system output. Furthermore, higher gain control was possible. T.M.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-10790 Washington Univ., St. Louis, Mo.
THE DIFFERENTIABILITY OF DISTANCE FUNCTIONS AND THE GSP IN BANACH SPACES Ph.D. Thesis
Simon Peter Fitzpatrick 1980 65 p
Avail: Univ. Microfilms Order No. 8026232

Two studies in Banach space theory are presented. The first examines the relationship between the differentiability of the distance from a point to a fixed closed set and the existence and continuity of the associated metric projection, with similar results for the metric antiprojection and the farthest distance from a bounded set. The second studies the GSP, a property of bounded subsets of Banach spaces which is dual to the Radon-Nikodym property. Topological and geometric characterizations of the GSP are given, in particular, a bounded absolutely convex set K has the GSP if and only if every separable subset of K is weakly metrizable. A bounded set K in a Banach space E is shown to have the GSP if and only if every continuous convex function f on E is K differentiable on a residual subset of E, as a corollary of a characterization involving the generic K continuity of monotone operators on E. Dissert. Abstr.

N81-10791 Washington Univ., Seattle.
NORMALIZED BROWNIAN MOTION ON BANACH SPACES Ph.D. Thesis
Dennis Dean Cox 1980 206 p
Avail: Univ. Microfilms Order No. 8026333

Almost sure asymptotic properties of X(t)/gamma(t) as t yields infinity where investigated for the case where X is a Banach space valued Brownian motion and gamma is a regularly varying function. The existence of a natural rate of escape functions

is considered. It is shown that for infinite dimensional Brownian motions in lambda sup p spaces (p is equal to more than 1) with independent coordinates, such rate of escape functions always exist. The behavior of the norm of (X(t)/gamma(t) -y) is studied, where y is an arbitrary point in space. Two theorems are stated which when taken together, exhaustively characterize the possible asymptotic limit point sets of X(t)/gamma(t). If the limit point set is unempty, then it is the norm closure of a centered ball from a subspace which has a natural Hilbert space structure, where the radius of the ball may be 0 or infinity. Examples of lambda sup p valued Brownian motions are analyzed, and applied to empirical processes. Dissert. Abstr.

N81-10792 Oregon Univ., Eugene.
DUALITY AND ITS APPLICATIONS TO THE CHARACTER THEORY OF FINITE LIE GROUPS Ph.D. Thesis
Dean Leland Alvis 1980 95 p
Avail: Univ. Microfilms Order No. 8024840

The duality operation in the character ring of a finite Lie group is investigated. The necessary results from the character theory of finite groups and the needed structural properties of finite group of Lie type are reviewed. In it split (B,N) pairs, parabolic subgroups, and Levi decompositions are discussed. The operations of truncation to and induction from parabolic subgroups are examined. These operations are used in the construction of the duality operation. Results analogous to the Subgroup Theorem and intertwining Number Theorem are proved. The definition of the duality operation is given, and the basic properties of this operation are stated and proved. Formulas are derived relating the values of the dual character on semisimple classes to the values of the original character on certain other classes. The proof of a conjecture concerning the values of irreductible characters on unipotent classes is given. Dissert. Abstr.

N81-10793# Transkei Univ., Umtata (South Africa).
BANACH IDEALS OF OPERATORS DEFINED BY CLASSES OF CONE ABSOLUTELY SUMMING AND STRONGLY MAJORIZING MAPPINGS
Jurie J. Conradie and Johan Swart Nov. 1979 8 p refs
(CSIR-TWISK-129) Avail: NTIS HC A02/MF A01

The ideals of absolutely delta summing and dual absolutely delta summing mappings are characterized as 'quotients' by continuous linear mappings of certain classes of cone absolutely summing and strongly majorizing mappings respectively. The ideals of delta nuclear and right delta nuclear maps are also characterized as products of these two classes of operators with the class of continuous linear mappings. Two propositions are presented which suggest a way of generalizing the notions of absolutely delta summing and delta nuclear mappings. J.M.S.

N81-10794# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ON SCHWARTZ OPERATOR IDEALS DETERMINED BY THE ORDER-BOUNDED SETS IN A BANACH LATTICE
J. Swart and J. J. Conradie (Transkei Univ., Umtata, South Africa) Jan. 1980 33 p refs
(CSIR-TWISK-138) Avail: NTIS HC A03/MF A01

The p-nuclear operators are characterized as those operators factoring through l(p) for which one factor is strongly majorizing. Likewise the applications of p-nuclear are characterized as those l(p) factorizable operators for which one factor is cone absolutely summing. Results are obtained in the general setting of Schwartz operator ideals, and consequently it is possible to generalize the notions 'p-nuclear' and 'absolutely p-summing' to 'H-nuclear' and 'absolutely H-summing', where H is an arbitrary Banach lattice. S.F.

N81-10795# *Stanford Univ., Calif.* Dept. of Statistics.
THE VON MISES DISTRIBUTION IN p-DIMENSIONS WITH APPLICATIONS
Michael A. Stephens 4 Aug. 1980 34 p refs
(Contract N00014-76-C-0475; NR Proj. 042-267)
(AD-A089502; TR-290) Avail: NTIS HC A03/MF A01 CSCL 12/1

The theory of the von Mises distribution in p-dimensions is summarized, and it is shown how one or more sets of unit vectors, with p components, can be analyzed using this distribution. In particular, some extensions are made on the analysis of variance techniques first developed by Watson for two and three dimensions. An application is given to the analysis of continuous proportions for which the techniques supply a good methodology. Other examples are also briefly discussed. GRA

N81-10796# Wisconsin Univ. - Madison. Mathematics Research Center.
SPECTRAL THEORY OF MATRICES. 1: GENERAL MATRICES Summary Report
Shmuel Friedland May 1980 186 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A089635; MRC-TSR-2082) Avail: NTIS HC A09/MF A01 CSCL 12/1

This is the first of our survey reports on the spectral theory of matrices. The report is self contained from the matrix point of view. The main subject of this paper is the theory of analytic similarity of matrices. This topic of matrix theory is very important in the study of systems of ordinary differential equations having singularities either in time or a parameter. Author (GRA)

N81-10797 Boston Univ., Mass.
PROBABILITY ON FUZZY SETS Ph.D. Thesis
John Faust Buoncristiani 1980 101 p
Avail: Univ. Microfilms Order No. 8024177

Probability calculi for fuzzy sets are discussed. FS and their complements may be thought of as sets whose membership indicator or truth functions are maps from a background space, omega, into the unit interval. Two FS algebras are employed, each as a basis for a FS probability calculus. One employs minima for FS intersections and consequently maxima for unions. The other uses a product rule for intersections and a standard probability-like addition rule for unions. The derived two FS probability theories are not identical and neither is identical with standard probability theory. Fuzzy random variables, very fuzzy probabilities and dynamic fuzzy sets are included. Dissert. Abstr.

N81-10798 Brandeis Univ., Waltham, Mass.
GAUGE-NATURAL BUNDLES AND GENERALIZED GAUGE THEORIES Ph.D. Thesis
David John Eck 1980 82 p
Avail: Univ. Microfilms Order No. 8024524

The concept of gauge natural bundles is introduced. They are a generalization of natural bundles and provide a natural formal context for the discussion of gauge field theories. It is shown that such bundles correspond to actions of certain Lie groups on smooth manifolds and that natural differential operators between them correspond to equivariant maps. Some results of classical gauge theory are reformulated and reproved in terms of gauge natural bundles, including a theorem of Utiyama which describes first order gauge invariant Lagrangians on the bundle of connections of a principal bundle. Also, a method is described for constructing natural Lagrangians from gauge invariant Lagrangians. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N81-10799 Wisconsin Univ. - Milwaukee.
ANGULAR MOMENTUM IN CURVED SPACETIMES Ph.D. Thesis
Steven Paul Mayer 1980 101 p
Avail: Univ. Microfilms Order No. 8024958

The quantization of charge was studied. The electromagnetic field generated by an electric charge e and a (hypothetical) magnetic charge g contains a net angular momentum eg which is independent of the separation between the charges. If this angular momentum is quantized, then eg = 1/2nh. A metric with an axial Killing vector was considered. The angular momentum contained in the field of two charges e and g located on the axis of symmetry was calculated. A nonvanishing angular momentum, as defined by a surface integral at infinity, can exist when in an axisymmetric vacuum spaceline whose spacelike hypersurfaces are compact inside the surface of integration. A 3 space S was constructed which had a topological handle that

prevented defining a Killing vector globally, but which admitted a rotational Killing pseudovector, that is, a vector field up to sign. Dissert. Abstr.

N81-10800# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.
GLOBAL NONEXISTENCE OF SMOOTH ELECTRIC INDUCTION FIELDS IN ONE DIMENSIONAL NONLINEAR DIELECTRICS Interim Report
Frederick Bloom 1980 38 p refs
(Grant AF-AFOSR-3396-77; AF Proj. 2304)
(AD-A089449; AFOSR-80-0935TR) Avail: NTIS HC A03/MF A01 CSCL 20/3

Coupled nonlinear wave equations are derived for the evolution of the components of the electric induction field D in a class of rigid nonlinear dielectrics governed by the nonlinear constitutive relation E = lambda (D)D, where E is the electric field and lambda <0 is a scalar valued vector function. For the special case of a finite one dimensional dielectric rod, embedded in a perfect conductor, and subjected to a perpendicular electric field which depends only on variations of the coordinate along that axis, it is shown that, under relatively mild conditions on lambda, solutions of the corresponding initial boundary value problem for the electric induction field cannot exist globally in time in the L sub 2 sense; under slightly stronger assumptions on the constitutive function lambda, a standard Riemann invariant argument may be applied to show that the space-time gradient of the nonzero component of the electric induction field must blow up in finite time. The growth estimates for solutions, which are valid on the maximal time interval of existence are also derived. M.G.

N81-10801# Brown Univ., Providence, R. I. Dept. of Chemistry.
PHOTOELECTRONIC PROPERTIES OF TERNARY NIOBIUM OXIDES
K. Dwight and Aaron Wold 1 Sep. 1980 21 p refs Submitted for publication
(Contract N00014-77-C-0387; NR Proj. 359-653)
(AD-A089238; TR-12) Avail: NTIS HC A02/MF CSCL 20/3

A series of ternary niobium oxides were prepared and their photoelectronic properties evaluated. When two species of photoactive centers are simultaneously present, the higher flat-band potential appears to dominate. But it is evident that both species contribute their characteristic sets of inter-band transitions to the ensemble. In this respect, these oxide semiconductors behave differently than the conventional, broad-band semiconductors. It would appear that different photoactive centers remain at least partially independent. Hence, for FeNbO4, the data show all the characteristics of the (NbO6) octahedra in addition to all the characteristics of the (FeO6) centers. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-10802 Washington Univ., St. Louis, Mo.
AN ULTRASONIC ANNULAR ARRAY BASED ON QUADRATURE SAMPLING Ph.D. Thesis
Jeffrey Earl Powers 1980 188 p
Avail: Univ. Microfilms Order No. 8026202

An ultrasound pulse echo system is described which uses an annular array to achieve high resolution and beam geometry control over an extended depth. The continuous wave point spread functions of arbitrary individual elements were derived by expanding the Fresnel integral about an average radial coordinate. The extra term that is retained in the expansion gives the delays required for focusing. The general equations are solved for the case of an annular array, and the results are used in a computer model to predict the point spread function for any annular array geometry given the phasing between elements and their relative intensities. A system which uses the direct RF quadrature sampling technique to provide dynamic focusing for an annular array is described. Results are presented to demonstrate the utility of the sampling process. Several theoretical point spread functions are presented for comparison with the measured results. Doppler beam plots and spectral recording demonstrating the ability of the sampled delay lines to obtain physiological Doppler information are included. Dissert. Abstr.

N81-10803 Stanford Univ., Calif.
INFLUENCE OF NONHARMONIC PARTIALS ON TONE PRECEPTION Ph.D. Thesis
Elizabeth Ann Cohen 1980 189 p
Avail: Univ. Microfilms Order No. 8024636

Harmonic sounds were stretched by uniformly expanding the logarithmic frequency ratios between the fundamental frequencies of a tone in a scale and between each tone and its overtones. The problem addressed was whether an auditory system restriction exists that functions to limit the perception and consequently the use of nonharmonic tones. Interval Tuning tasks show that in the region of A = 1.9 to 2.1, interval ratios are stretched or compressed in proportion to the factor A/2, suggesting a match to one or more of the adjusted partials. Beyond the 1.9 to 2.1 region, a majority of subjects were seen to rely on memory of the sound of conventional intervals. However, one subject consistently performed according to a Partial Matching hypothesis. Subject performance indicates that the further use of nonharmonic materials must take into account that nonharmonic tones may have more than one meaning, but control over context can explicitly specify the intended meaning. Subjects were asked to insert a missing 2nd partial. Except for one, the subjects showed little evidence of discerning organized partial structure when the base exceeds the limits 1.9 to 2.1. Dissert. Abstr.

N81-10804 Stanford Univ., Calif.
LINEAR AND NONLINEAR IMAGING IN A THREE-LENS SCANNING ACOUSTIC MICROSCOPE Ph.D. Thesis
Celia Elizabeth Yeack 1980 218 p
Avail: Univ. Microfilms Order No. 8024763

The design and construction of a three-lens scanning acoustic microscope is described. The versatility of the three-lens system allowed investigation of a variety of materials in unique acoustic imaging configurations. Oblique incidence reflection and transmission acoustic imaging is described and results for several classes of materials are explained theoretically. This instrument allowed oblique incidence reflection acoustic microscope studies of materials in both a specular reflection and non-specular (or dark field) mode. Oblique incidence transmission is briefly described. Nonlinear acoustic imaging is described. Dissert. Abstr.

N81-10805 Missouri Univ. - Columbia.
SOUND-WAVE PROPAGATION IN A RAREFIED GAS Ph.D. Thesis
Teh-Chin Cheng 1980 159 p
Avail: Univ. Microfilms Order No. 8024347

The problem of sound wave propagation in a rarefied gas is studied by the use of modeled linearized Boltzmann equations and diffuse reflection boundary conditions. The models of the Boltzmann equation which were adopted are the BGK model and the Gross-Jackson (N = 5) model. The relevant integrodifferential equation and boundary conditions for the half space are converted into a system of linear integral equations, which is then solved by a straightforward numerical difference technique. From the solutions of the modeled linearized Boltzmann equation, the sound wave dispersion relations over a wide range of Knudsen number are obtained. The present results are in good agreement with the experimental results of Meyer and Sessler and Greenspan. Furthermore, a comparison of the results of the BGK model and the results of the Gross-Jackson (N = 5) model indicates that the sound wave dispersion law is only slightly model dependent for monatomic gas of Maxwell molecules. Some are preliminary numerical results of the variable collision frequency model are also presented. Dissert. Abstr.

N81-10806 Pennsylvania State Univ., University Park.
A STUDY OF THE NEARFIELD OF AN EXCITED SPHERICAL SHELL Ph.D. Thesis
Edmond Hiu-Yu Wong 1980 232 p
Avail: Univ. Microfilms Order No. 8024508

Elastic spherical shell resonances were computed when in vacuo and when submerged in air and water. These were verified experimentally by testing two duralumin shells. The measured resonance frequencies were within 5% of those predicted in air and in water for identified mode numbers up to 34. The measured mean-line driving point admittance also agreed well with the predicted ones to within 3 dB. The exact wave harmonic series and the approximate geometrical theory of diffraction (GTD) were used to predict the acoustic nearfield of an elastic spherical shell insonified by an acoustic point source. The predicted normalized, acoustic nearfield pressure computed by the exact solution agreed very well with the measured ones for frequencies up to Ka = 30. The nearfield acoustic pressure was also computed by the GTD method with a locally reacting impedance assumed for the spherical surface. The GTD solutions were generally 60 dB or more lower than the exact ones. The source of the discrepancy was traced to the structure-borne resonant vibration which is not accounted for in the GTD. Dissert. Abstr.

N81-10807*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NEW INTERPRETATIONS OF SHOCK-ASSOCIATED NOISE WITH AND WITHOUT SCREECH

U. vonGlahn 21 Nov. 1980 25 p refs To be presented at the 100th Meeting of the ASA, Los Angeles, 17-21 Nov. 1980 (NASA-TM-81590; E-569) Avail: NTIS HC A02/MF A01 CSCL 20A

Anomalous trends in present convergent nozzle (Mach 1) shock associated noise analyses and predictions, with particular emphasis on the roles of screech and jet temperature, are discussed. Experimentally measured values of shock associated noise are used to reassess data trends, including both frequency and sound pressure level. The data used includes model-scale nozzles, varying in nominal diameter from 5 cm to 13 cm, and full scale engine nozzles up to 48 cm. All data were obtained at static conditions. From this reassessment of the measured data, new empirical methods for the prediction of shock associated noise are developed. Separate procedures are presented for screech free and screech contaminated shock associated noise. In the present approach, shock associated noise spectra are developed from considerations that include the peak sound pressure level and its frequency, the low frequency sound pressure level slope, and the high frequency sound pressure level slope or roll-off; the latter is shown to vary with directivity angle.

Author

N81-10808# Naval Research Lab., Washington, D. C. Applied Ocean Acoustics Branch.

MODAL ACOUSTIC TRANSMISSION LOSS (MOATL): A TRANSMISSION-LOSS COMPUTER PROGRAM USING A NORMAL-MODE MODEL OF THE ACOUSTIC FIELD IN THE OCEAN Interim Report

John F. Miller and Stephen N. Wolf 27 Aug. 1980 128 p (AD-A089367; NRL-8429) Avail: NTIS HC A07/MF A01 CSCL 20/1

A FORTRAN program which calculates coherent and incoherent acoustic transmission loss is described. The program is based on normal-mode theory of ocean acoustics. The theory models the ocean as two fluid layers, each with an arbitrary sound-speed profile, which overlay a uniform half-space. The half-space may be a fluid or a shear-supporting solid. The model incorporates losses due to acoustic absorption in all three media and losses due to roughness of the upper and lower boundaries of the upper fluid layer. An acoustic environment changing slowly with range is treated using the adiabatic approximation. GRA

N81-10809# Oxford Univ. (England). Dept. of Engineering Science.

***THE UNDERWATER JET NOISE RIG: A WORKING REPORT* 1978 TO 1979**

R. E. Franklin and J. McMillan Mar. 1980 78 p refs *(Contract ERC/9/4/2057/70)* (OUEL-1310/80) Avail: NTIS HC A05/MF A01

An underwater jet rig was developed and experiments run showing that it can be used successfully to study a wide range of problems. Extraneous low and middle frequency noise which was found to have been transmitted by vibrations of the inlet pipework to the nozzle and has been virtually eliminated by modifications to the rig. The rig can provide accurate and highly repeatable interference-free noise spectra for water jets up to 2 in. dia. and jet speeds up to 67 ft sec, and experiments with jets of three different diameters show that the spectra are consistent with those published by other workers for single phase jets. The high frequency levels of the jet noise spectra, even at high cavitation numbers, are shown to be highly sensitive to the concentration of micro bubbles of air in the water flow. There is evidence that the bubbles may give rise to interference by vibration noise. With small diameter jets, sustained running of the rig can be achieved at very low concentrations of micro bubbles with negligible background noise throughout the frequency range of measurement, 20 Hz to 40 KHz. Author (ESA)

N81-10810# Centre Technique des Industries Mecaniques, Senlis (France).

ACOUSTIC RADIATION CALCULATIONS Ph.D Thesis Final Report [CALCUL DU RAYONNEMENT ACOUSTIQUE]

Nabil Sayhi 30 Jan. 1980 193 p refs In FRENCH (CETIM-1-1H-13-0) Avail: NTIS HC A09/MF A01

The acoustic field generated by a vibrating body immersed in an infinite fluid medium was studied. Integral formulations are expressed in discrete form. Near, mean distance, and far field characteristics are then obtained from the linear numerical system subsequently deduced. The validity of the method is demonstrated from the results of numerical tests carried out on classical examples such as (spheres and cylinders). Author (ESA)

N81-11004# Joint Publications Research Service, Arlington, Va.

VW PROGRESS IN VEHICLE ACOUSTIC TECHNOLOGY EXAMINED

Ulrich Sorgatz *In its* West Europe Rept.: Sci. and Technol., No. 4 (JPRS-74613) 21 Nov. 1979 p 61-78 refs Transl. into ENGLISH from Automobil Industrie (Wuerzburg, West Germany), no. 3, Sep. 1979 p 47-54 (For primary document see N81-11001 01-99)

Avail: NTIS HC A06/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-10811 Oregon Univ., Eugene.

***HYDROGEN-BONDED COMPLEXES: MOLECULAR BEAM* ELECTRIC DEFLECTION AND ELECTRIC RESONANCE STUDIES AND SYMMETRY GROUPS Ph.D. Thesis**

Jamiu Aseola Odutola 1980 191 p

Avail: Univ. Microfilms Order No. 8024877

Molecular beams containing dimers and polymers of HNO3, HCOOH, CH3COOH, CH3OH, C2H5OH, NH3, CH3NH2, (CH3)2NH, H2S and CH3SH were generated by supersonic expansion of appropriate gas samples through a pin hole nozzle source. The molecular beam electric deflection behavior of these complexes in an inhomogeneous electric field was used to determine the presence or absence of an electric dipole moment in each molecular species. Nitric acid dimer and carboxylic acid dimers were found to be nonpolar and cyclic hydrogen bonded ring structures were found to be consistent with such results. The dimers of alcohols, ammonia, amines, hydrogen sulphide and mercaptan were polar and this is consistent with linear hydrogen bonded structures for these molecules. Molecular beam electric resonance (microwave and radio frequency) spectra of six isotopically distinct species of water dimer were obtained. Supersonic nozzle beams of argon seeded with water were found to give large enhancement in signal-to-noise ratios for the spectroscopic studies, thus enabling resolution of the hyperfine structures. Dissert. Abstr.

N81-10812 *Washington Univ., St. Louis, Mo.*

LOW ENERGY INELASTIC PION SCATTERING TO THE CONTINUUM Ph.D. Thesis

David Tsung-Chun Chiang 1980 213 p

Avail: Univ. Microfilms Order No. 8026213

The (pi,pi) reaction of Mg, Ca, Ni, Zr, Sn, and Pb was studied at several incident pion energies below the 3-3 resonance. In the spectra of Mg, Ca, and Ni a giant resonance like bump was observed at 67 MeV indicent pion energy. Analysis based on distorted wave impulse approximation was made. For Ca and Ni the observed bump is interpreted as a linear combination of the giant dipole and the isoscalar giant quadrupole resonances. For Ca the bump became too weak to be observed in the spectra obtained at 85 MeV. This result was explained in terms of DWIA calculations. The energy integrated cross sections were estimated from the measured spectra, and the total inelastic pion scattering cross sections were obtained. The total inelastic cross sections depend on the nuclear mass number as A0.4. A semiclassical model was used to interpret the total inelastic cross sections in terms of a ratio of the true meson absorption strength to the total reaction strength. This ratio is approximately 0.7 for all nuclei studied. Dissert. Abstr.

N81-10813 Stanford Univ., Calif.

CONFIGURATION MIXING AND ELASTIC MAGNETIC ELECTRON SCATTERING Ph.D. Thesis

Ahmet Gokalp 1980 80 p

Avail: Univ. Microfilms Order No. 8024664

The effects of configuration mixing in the analysis of the elastic magnetic electron scattering experiments on Titanium 49, Cobalt 59, and Strontium 87 are studied by allowing one particle two hole admixtures in the ground state wave functions of these nuclei. The results indicate that configuration mixing may be significant for some cases, however more data and/or more information about the ground states of these nuclei are needed to reach a more definite conclusion. The ground state of Niobium 93 is studied by employing a configuration space which involves neutron as well as proton configurations. The effect of the details of the ground state wave function are shown to be not significant for the extraction of the root mean square radius of the valence proton from the data. The effects of the meson exchange currents together with configuration mixing are investigated. Ground state wave functions that include configuration mixing are employed. The meson exchange currents are shown to be an important effect which must be taken into account in the analysis of these experiments. Dissert. Abstr.

N81-10814 Stanford Univ., Calif.

IDENTIFICATION OF EXCITED STATES OF DIATOMIC SODIUM BY TWO-STEP POLARIZATION LABELING Ph.D. Thesis

Nils William Carlson 1980 121 p

Avail: Univ. Microfilms Order No. 8024632

The absorption spectra for single vibrational-rotational levels of two excited singlet states of Na2 to new excited electronic states are obtained by using Two-Step Polarization Labeling. By applying this technique to Na2, a total of eighteen excited singlet states were identified which were not previously known. Before this work only six singlet states of Na2 were identified. It was possible to obtain some of the vibrational and rotational constants for all of these new states. The electronic energies of these states form a Rydberg series which can be explained by considering a model where a single electron interacts with an axially symmetric field. The Two-Step Polarization Labeling is an extremely effective technique for the study of molecular Rydberg states.

Dissert. Abstr.

N81-10815 City Univ. of New York, N. Y.

CROSS POLARIZATION RESONANT FLUORESCENCE *Ph.D. Thesis*

James Kourlas 1980 102 p

Avail: Univ. Microfilms Order No. 8023715

Resonant fluorescent spectra are calculated in cases where the incident laser radiation is linearly polarized and fluorescent radiation circularly polarized. The incident radiation is coherent, *monochromatic, and sufficiently intense to enable AC Stark* splitting of the atomic levels. The long time limit spectra are calculated when the atom consists of two magnetically degenerate levels. In addition, the spectra are derived when the degeneracy is removed by a constant magnetic field. Both cases are *reexamined when the laser radiation deviates from strict coherence* and monochromaticity. Dissert. Abstr.

N81-10816 California Univ., Riverside.

MESON BOUND STATES AND INCLUSIVE HADRON SCATTERING IN QUANTUM CHROMODYNAMICS Ph.D. Thesis

Dana Richard Beavis 1980 129 p

Avail: Univ. Microfilms Order No. 8024977

The constituent framework and quantum chromodynamics were studied. In the first part we study the charmonium and Tau systems with a simple Coulomb plus linear potential. The lowest order spin-dependent and spin-independent corrections were included. The parameters of the potential were determined by the charmonium states other than 1S0 states. Asymptotic freedom was incorporated in the short range potential. It was found that asymptotic freedom greatly suppresses the hyperfine splittings and gives S-state level spacings which are nearly quark mass independent. The Lorentz nature of the confinement potential was determined to be an equal mixture of vector and scale. A method for obtaining bound states and wavefunctions for relativistic confined systems was extended. The important aspect of this treatment is that the input is the asymptotic expansion of the two-point functions. Thus information about the hadron masses can be obtained directly from the underlying field theory. The bound state approximation for a system defined by an equivalent potential V(r) = lambda squared tanh squared (g squared r/lambda) was tested. Excellent results are obtained, even though a threshold is present. The 100 GeV/c pion(-) implies pion(0) data of Barnes et al. for moderate t, with the constituent scattering models were evaluated. Dissert. Abstr.

N81-10817 California Univ., Riverside.

THE EQUILIBRIUM CONSTANT OF COMPLEX FORMATION IN SOLUTION: A STUDY UTILIZING A DIELECTRIC CONSTANT METHOD Ph.D. Thesis

Cheng-Wah Loh 1980 140 p

Avail: Univ. Microfilms Order No. 8024991

A method was developed for determining equilibrium constants, heat of reaction, and change in free energy and entropy during a 1:1 complex formation in solutions. The measurements were carried out on ternary systems containing two interacting solutes in an inert solvent. The procedures was applied to the investigation of hydrogen bond complex formations in two mixtures systems, phenol and pyridine in carbon tetrachloride, and 4, 5, 6, 7-tetrachloro-2-trifluoromethylbenzimidazole (TTFB) and alkyl acetate in styrene. The first mixture system was studied in order to compare the results with those obtained by other methods. Results for the second mixture system indicated strong association between molecules of TTFB and alkyl acetate and suggested that the blocking of valinomycin-mediated bilayer membrane conductance by substituted benzimidazoles was due to competition for a limited number of adsorption sites on the membrane surface. Dissert. Abstr.

N81-10818 Rochester Univ., N. Y.

EFFECT OF TEMPERATURE ON THE MULTIPLE PHOTON ABSORPTION OF POLYATOMIC MOLECULES Ph.D. Thesis

Wei-Shin Tsay 1980 191 p

Avail: Univ. Microfilms Order No. 8023946

The effect of temperature on the multiple photon absorption *of polyatomic molecules was investigated. A transmission* measurement was used which gave the average number of photons absorbed per molecule in the laser beam path as functions of *laser frequency, energy fluence, gas temperature, pressure and* molecular species. A method for determining the fraction of molecules participating in the multiple photon absorption process *at P24 and P28 laser frequencies was developed. It was* concluded that the fraction is a strong function of gas temperature but depends only weakly on the laser fluence in the region of hot band absorptions. The fraction determined by this method enabled a quantitative comparison of laser excitation with *thermal heating. Laser excitation was found to be different from* thermal heating at least up to an average absorption of 4 photons. Only molecules with the pumped mode and the lower frequency *modes both degenerate have thermal enhancements of the* multiple photon absorption. Dissert. Abstr.

N81-10819 Boston Univ., Mass.

FEASIBILITY OF A MOLECULAR TEST OF LOCAL HIDDEN-

VARIABLES THEORIES Ph.D. Thesis
Tak Kui Lo 1980 284 p
Avail: Univ. Microfilms Order No. 8024203

An experimental refutation of local hidden-variables theories is discussed wherein spin correlations of atom pairs in an electronic singlet spin state are observed. The creation of a Na atom pair forming the electronic singlet spin state is studied through excitation of a Na2 molecule in the electronic ground state X(1)sigma G + to the continuum of the electronic ground state by the induced Raman effect. Two laser beams are used, one for excitation to a virtual intermediate state in A(1)sigma u+, one to induce the downward transition to the final state. A calculation estimating the rate of coincident detections of Na atom pairs is presented. The conditions necessary for the experiment to successfully distinguish between local hidden-variables theories and quantum mechanics are examined.
Dissert. Abstr.

N81-10820 Pennsylvania State Univ., University Park.
INTERMEDIATE COUPLING COLLISION STRENGTHS FOR HIGHLY CHARGED IONS Ph.D. Thesis
Robert Edward Clark 1980 235 p
Avail: Univ. Microfilms Order No. 8024437

The theory of collision strengths or cross sections for excitation of highly charged ions by electron impact in the nonrelativistic limit is reviewed from a perturbation theory point of view. Configuration interaction and intermediate coupling effects are taken into account through the use of mixing coefficients obtained by diagonalization of the perturbation to the Hamiltonian. This perturbation is chosen to be the dominant relativistic corrections plus the entire electrostatic interaction between the electrons. It is shown that the configuration mixed intermediate coupled collision strength can be expressed in terms of hydrogenic reactance matrix elements and the mixing coefficients. Application is made to complex ions with two, three and four electrons. Radiative line strengths are also computed. Results for collision strengths, transition energies and line strengths are compared with data obtained by other means. Dissert. Abstr.

N81-10821 Michigan Univ., Ann Arbor.
A DIRECT INELASTIC SCATTERING CROSS-SECTION FOR NEUTRONS SCATTERED BY NON-SPHERICAL NUCLEI Ph.D. Thesis
Brahim Sadallah 1980 106 p
Avail: Univ. Microfilms Order No. 8025763

A computation of a direct (not compound nuclear) inelastic scattering cross section for neutrons scattered by nonspherical nuclei is presented. More specifically, a direct inelastic scattering cross section for the excitation of the rotational I+ level (I is the rotational angular momentum) of the ground state rotational band of heavy deformed even-even nuclei is calculated. The results provide relatively simple, analytic, and quantitative estimates of the cross sections, and interrelationships among them. The cross section for the O+ approaches 2+ transition, which is the most prominent among inelastic cross section associated with higher rotational excitation is compared with the corresponding cross section observed for w(182) and w(86). It is found that the theoretical results correlate fairly well with the experimental results over the incident neutron energies ranging from the threshold to 3 MeV. The application of the derived cross section to investigate the average energy lost by the neutron per collision is also included. Moderation of neutrons through direct inelastic collision with heavy nuclei is important as compared with that of elastic collisions with the same model. Dissert. Abstr.

N81-10822# SRI International Corp., Menlo Park, Calif.
ENERGY TRANSFER REACTIONS OF EXCITED ATOMS AND MOLECULES Final Report, 16 May 1977 - 15 May 1980
Tom G. Slanger 28 Jul. 1980 36 p refs
(Contract DAAG29-77-C-0018)
(AD-A089203; SRI-MP-80-87; ARO-14708.4-C) Avail: NTIS HC A03/MF A01 CSCL 07/4

Five main areas have been investigated: (1) observations of the three metastable states of O2 with excitation energies between 4 and 5 eV have been made in afterglow systems, (2) a new energy transfer process has been discovered in the NO molecule; (3) using the H2 laser, direct observations were made of O(1D) radiation at 6300 A from O2 photodissociation; (4) the product channels for the quenching of O(1S) by O(3P) have been investigated; and (5) quenching of O(1S) by the species in an oxygen-helium afterglow gives convincing evidence that the most important quenching molecule is O2, with a rate coefficient of approximately gas kinetic collision frequency. GRA

N81-10823# Montpellier Univ. (France). Dept. de Physique Mathematique.
LEPTONIC AND HADRONIC CORRECTIONS TO MASS AND PROPAGATOR OF W AND Z BOSONS
M. Capdequi-Peyranere, F. M. Renard, and M. Talon Jan. 1980 30 p refs
(PM/80/1) Avail: NTIS HC A03/MF A01

The effects of high order terms due to fermion loops (lepton and quarks) on the properties of W and Z bosons are studied by means of the propagator formalism. In particular, the boson mass ratio Mw sq/Mz sq cos sq theta, and the energy dependence of the form factors associated to time-like or space-like M, W or gamma exchanges are more accurately determined. Results consist in making explicit the effects of the energy dependence of the W and Z propagators, taking into account the existence of strong interactions between quarks and the formation of vector mesons, calculating the corrections to the above form factors, and discussing quantitatively the effects of lepton and quark doublets on the ratio, the angle, and the form factors. Author (ESA)

N81-10824# Stockholm Univ. (Sweden). Inst. of Physics.
AN ANALYSIS OF HYPERFINE INTERACTIONS IN THE ELECTRONIC SPECTRUM OF AlF. PART 2: WAVE NUMBERS AND EXAMPLES OF INTENSITY PROFILES
J. M. Brown (Southampton Univ., England), I. Kopp, C. Malmberg, and B. Rydh Oct. 1979 48 p
(USIP-79-15) Avail: NTIS HC A03/MF A01

Nine singlet and seven triplet states assigned to the AlF (++) molecule were investigated and ordered into a common energy scheme. The transitions b-a and c-a were studied. The wave numbers are given in table form. The calculation procedure for transition between individual F states was described in part one. Author (ESA)

N81-10825 Wisconsin Univ. - Milwaukee.
INFLUENCE OF INTER- AND INTRAMOLECULAR INTERACTIONS ON DIELECTRIC RELAXATION Ph.D. Thesis
Robert L. Gaither 1980 103 p
Avail: Univ. Microfilms Order No. 8015200

Measurements of complex dielectric permittivity of neat acetonitrile are combined with far infrared absorption spectra and inverted to yield the dipolar correlation function gamma (t). Upon analysis with a computer program specifically designed to avoid the pitfalls of conventional least squares fitting, gamma (t) is found to be best fit by a sum of two exponential terms. This result is in agreement with a theory proposed to predict the effect of long-range multipolar forces on dielectric relaxation. Cross-correlations in acetonitrile are found not to affect the results. Two models proposed to explain the anomalous dielectric relaxation of diphenyl either (and similar molecules) are examined. A discrete sit model for dielectric relaxation of chain molecules was applied to alpha and alpha, omega- substituted haloalkanes with the goal of determining to what extent intramolecular motion contributes to relaxation of the total dipole moment. Dissert. Abstr.

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N81-10826 Virginia Univ., Charlottesville.
DEEP INELASTIC ELECTRON SCATTERING FROM IRON 56 AND OTHER TAILS Ph.D. Thesis
Rosemary Martha Altemus 1980 186 p

Avail: Univ. Microfilms Order No. 8024059

Deep inelastic electron scattering data on iron 56 are presented for angles of 160 degrees, 140 degrees and 90 degrees and at incident energies ranging from 372 MeV to 100 MeV. Radiative contributions from real target bremsstrahlung and from the continuum are included. The data were separated into longitudinal, Sl(q, omega) and transverse, ST(q, omega) response functions. A Coulomb sum rule for constant q is formulated and compared with an independent particle model (Fermi gas). Short range correlations, finite size effects, effective momentum transfer and final state interactions are considered in an attempt to explain the observed discrepancies. Dissert. Abstr.

N81-10827 Rochester Univ., N. Y.

STATISTICAL SPECTROSCOPIC STUDIES IN NUCLEAR STRUCTURE PHYSICS Ph.D. Thesis

Thirumala Raya Halemane 1980 175 p

Avail: Univ. Microfilms Order No. 8023927

Utilizing the centroid and width of the energy spectrum and partitioning the model space according to different group symmetries, simple and physically meaningful expansions are obtained for the model interactions. Numerical results for six (ds)-shell interactions and for scalar-isospin, configuration-isospin, space symmetry, supermultiplet and SU(e) SU(4) group structures are presented. The notion of simultaneous propagation of operator averages in the irreps of two or more groups (not necessarily commuting) is also introduced. The non-energy-weighted sum rule (NEWSR) for electric and magnetic multipole excitations in the (ds)-shell nuclei Ne-20, Mg-24, Si-28, S-28, and Ar-36 are evaluated. A generally applicable procedure for evaluating the eigenvalue bound to the NEWSR is presented and numerical results obtained for the said excitations and nuclei. Comparisons are made with experimental data and shell-model results. By this sum-rule analysis, the known inadequacy of the (ds)-shell model space to explain the observed isoscalar quadrupole strengths in these nuclei are proved. A general theory is given for the linear-energy-weighted sum rule. A statistical approach to perturbation theory and inverse-energy-weighted sum rules are developed. Dissert. Abstr.

N81-10828# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Waste Management Planning Div.

LONG-TERM HIGH-LEVEL WASTE TECHNOLOGY Composite Quarterly Technical Report, Jan. - Mar. 1980

W. R. Corman, comp. Jul. 1980 58 p refs

(Contract DE-AC09-76SR-00001)

(DP-80-157-1) Avail: NTIS HC A04/MF A01

This series of reports summarizes research and development studies on the immobilization of high level wastes from the chemical reprocessing of nuclear reactor fuels. Immobilization of the wastes (defense and commercial) consists of placing them in a high integrity form with a very low potential for radionuclide release. Immobilization of commercial wastes is being considered on a contingency basis in the event that reprocessing is resumed. The basic plan for meeting the goal of immobilization of the DOE high level wastes is: (1) to develop technology to support a realistic choice of waste form alternatives for each of the three DOE sites; (2) to develop product and processing technology with sufficient scaleup to provide design data for full scale facilities; and (3) to construct and operate the facilities. DOE

N81-10829# Sandia Labs., Albuquerque, N. Mex.

SUBSEABED RADIOACTIVE WASTE DISPOSAL FEASIBILITY PROGRAM: OCEAN ENGINEERING CHALLENGES FOR THE 80'S

D. M. Talbert 1980 16 p refs Presented at IEEE/Oceans '80 Conf., Seattle, 8 Sep. 1980

(SAND-80-0304C; CONF-800921-1) Avail: NTIS HC A02/MF A01

The feasibility of disposing of high level radioactive wastes or spent fuel in suitable geologic formations beneath the deep ocean floor was assessed. While the current phase of the program to determine the scientific and environmental feasibility of the concept is not yet complete, activities to assess the engineering aspects are being initiated in parallel to facilitate the development of the concept on a time scale commensurate with other related programs both in the United States and abroad. It is anticipated that engineering aspects will become the central focus of the program during the early 80's and will continue so through the establishment of a pilot plant level activity which could occur by the mid 90's. DOE

N81-10830# Los Alamos Scientific Lab., N. Mex.

GENERAL-PURPOSE HEAT SOURCE PROJECT AND SPACE NUCLEAR SAFETY AND FUELS PROGRAM Progress Report, Mar. 1980

W. J. Maraman, comp. Jul. 1980 52 p

(Contract W-7405-eng-36)

(LA-8431-PR) Avail: NTIS HC A04/MF A01

The use of 238PuO2 in radioisotopic power systems is discussed. More specifically, the results from the graphite impact shell tests are discussed, along with fuel pellet development. DOE

N81-10831# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Dept. de Dynamique des Fluides Generales et de l'Environnement.

POST ACCIDENTAL HEAT REMOVAL (PAHR): EUROPEAN PROGRAM. FUNDAMENTAL, EXPERIMENTAL, AND THEORETICAL WORK ON THE PAHR SITUATION

C. Joly and J. M. Buchlin Mar. 1979 23 p Presented at Informal Meeting, Brussels, 5-6 Mar. 1979 Submitted for publication

(VKI-Preprint-1979-9) Avail: NTIS HC A02/MF A01

Out-of-pile experiments with simulant materials and the development of a theoretical approach leading to a better understanding of the Post Accident Heat Removal (PAHR) situation are discussed. A table is presented which summarizes the main phenomena to be analyzed by the PAHR program. The test facilities which are to be developed within the scope of the study are described. Some preliminary results are presented in terms of a two phase model in which only conductive heat transfer is considered. Author (ESA)

N81-10487*# Ebasco Services, Inc., Greensboro, N.C.

APPLICATIONS OF SLAR IN NUCLEAR POWER PLANT SITING: A CASE HISTORY

Barry S. Siegal *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 293-303 refs (For primary document see N81-10472 01-42)

Avail: NTIS HC A22/MF A01 CSCL 18E

74 OPTICS

Includes light phenomena.

N81-10832 Rochester Univ., N. Y.

THEORY OF COHERENT PROPAGATION OF SHORT DIFFERENT WAVE LENGTH OPTICAL PULSES IN THREE LEVEL ABSORBERS Ph.D. Thesis

Marek Jan Konopnicki 1980 220 p

Avail: Univ. Microfilms Order No. 8023931

Propagation of short different wavelength optical pulses in 3 level absorbers is studied. Combined numerical and analytic techniques are used to solve the 3 level Maxwell Bloch equations constituting the semiclassical description of the problem. The electric field in the model consists of two copropagating plane waves, each of which is in near resonance with a transition in the absorber. The following phenomena are included in the model: internal population conserving relaxation, ionization and other nonconservative losses, Doppler broadening of the transition linewidths and laser atom frequency mismatches. A solution of the Bloch equations of an atom interacting with pulses of the same time dependence but different amplitudes is found. The possibility of simultaneous lossless different wavelength propagation of several pulses is studied. Analytic solutions having the form of simultaneous different wavelength optical solitons are found. In order to treat optical pulse propagation in 3 level media, a program for the numerical integration of the coupled 2 pulse Maxwell Bloch equations is developed. Dissert. Abstr.

N81-10833 Arizona Univ., Tucson.

OPTICAL PROPERTIES OF CHEMICAL VAPOR DEPOSITED MOLYBDENUM THIN FILMS Ph.D. Thesis

Gary Ernest Carver 1980 226 p
Avail: Univ. Microfilms Order No. 8025223

Reasons for differences between the infrared reflectance of chemical vapor deposited (CVD) molybdenum (Mo) thin films and polished, bulk Mo were investigated. Molybdenum was chosen for this investigation because substantial differences of up to 22% were observed between the infrared reflectance of thin film and bulk Mo. An understanding of the anomalous reflectance of thin film Mo will lead to the capability of reproducibly depositing Mo thin films with bulk-like reflectance. This will benefit applications of thin film Mo which depend on both the thermal stability and high infrared reflectance of Mo. Dissert. Abstr.

N81-10834 Michigan Univ., Ann Arbor.
STIMULATED SCATTERING AND NONLINEAR OPTICS Ph.D. Thesis
Boualem Hammouda 1980 135 p
Avail: Univ. Microfilms Order No. 8025693

Nonlinearities in the radiation field relevant to laser fusion are addressed. To describe the radiation field the photon transport theory is used because of its mathematical simplicity, natural separation of microscopic versus macroscopic nonlinearities and treatment of matter dynamics to any desired level of approximation. Since the only concern here is in microscopic nonlinearities, matter (plasma or neutral media) is described as in thermal equilibrium. Stimulated scattering by plasmas (stimulated Brillouin scattering, stimulated Raman scattering) as well as neutral media (stimulated Brillouin scattering) is investigated. The nonlinear inverse bremsstrahlung absorption in plasmas and some other nonlinearities relevant to high power laser amplifiers (nonlinear index of refraction, nonlinear absorption, nonlinear gain) are also discussed. An unnoted mechanism for nonlinear gain saturation (especially in CO2 laser amplifiers) intensity broadening of the upper laser level is briefly discussed. Dissert. Abstr.

N81-10835# Siemens A.G., Munich (West Germany). Research Lab.
TAPPING ELEMENTS FOR OPTICAL FIBERS Final Report
Hans-Hermann Witte, Franz Auracher, and Michael Stockmann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 88 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-178) Avail: NTIS HC A05/MF A01

A simple reproducible process for fabricating tapping elements is described. Optical losses are minimum. Thick film technology with conventional photolithography is used. Structures were designed to match the properties of the optically sensitive material. Theoretical considerations are presented and it is shown how optimum performance can be achieved. Concrete examples of realizations are given together with their characteristics and the results obtained. Practical applications in the data bus sector, e.g., for multiprocessing systems and TV program distribution networks, are presented. Author (ESA)

N81-10836# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
FIGURES OF MERIT FOR MIRROR MATERIALS Interim Report
Ernest G. Wolff 10 Jul. 1980 42 p refs
(Contract F04701-79-C-0080; DARPA Order 3646)
(AD-A089404; TR-0080(5762-02)1; SD-TR-80-35) Avail: NTIS HC A03/MF A01 CSCL 20/6

Potential mechanisms that result in excessive wavefront distortions by large mirrors are reviewed, with the objective of defining the mirror substrate material property requirements in each case. A generalized figure of merit is found to require maximal thermal conductivity, elastic modulus, strength, melting point, and dimensional stability. The thermal expansion coefficients and their variability must be minimized. The analyses can be used to optimize mirror design and materials for a wide range of mechanical and thermal loading conditions. GRA

N81-10837# Optical Sciences Co., Placentia, Calif.
ANALYSIS OF ADVANCED CI APPLICATIONS AND SYSTEMS PERFORMANCE Interim Report, Oct. 1979 - Mar. 1980
David L. Fried Griffiss AFB, N.Y. RADC Jun. 1980 56 p
(Contract F30602-79-C-0062; ARPA Order 2646; AF Proj. 2646)
(AD-A089197; DR-169; RADC-TR-80-219) Avail: NTIS HC A04/MF A01 CSCL 20/6

In this report, three problems associated with compensated imaging and adaptive optics are considered. Chapter 1 is concerned with the matter of the effect of turbulence induced intensity variations at an aperture upon the antenna gain achievable when the aperture is used as a laser transmitter. Chapter 2 treats a problem related to image recovery from speckle interferometry data, namely the question of ambiguity in the result when the image recovery is based on nonnegativity of intensity. Chapter 3 examines a concept for producing low voltage multielement adaptive optics deformable mirrors. GRA

N81-10838# Arizona Univ., Tucson. Dept. of Chemistry.
DETERMINATION OF THE ULTRAVIOLET AND VISIBLE RESPONSE OF A CHARGE: INJECTION DEVICE ARRAY DETECTOR Interim Report
H. A. Lewis and M. B. Denton Aug. 1980 28 p refs Submitted for publication
(Contract N00014-75-C-0513; NR Proj. 051-549)
(AD-A089302; TR-25) Avail: NTIS HC A03/MF A01 CSCL 17/5

The potential of charge-injection device (CID) electronic cameras as multichannel spectroscopic detectors is discussed. Data is presented giving the UV/visible spectral response of five CID sensors. This data shows that these sensors have the ultraviolet response necessary for their application as detectors in elemental analysis. GRA

N81-10839# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
IN SITU MEASUREMENT OF THE RATIO OF AEROSOL ABSORPTION TO EXTINCTION COEFFICIENT
Charles W. Bruce, Young Paul Yee, and S. G. Jennings (Univ. of Manchester, England) Aug. 1980 32 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A089452; ERADCOM/ASL-TR-0064) Avail: NTIS HC A03/MF A01 CSCL 20/6

A knowledge of the proportion of absorbed to scattered radiation for countermeasure smokes is necessary for modeling battlefield effects. Measurement of the total scattered component, however, is difficult. This report presents results obtained by using a new and simpler approach focussing on the extinction and the absorption coefficients (the total scattering coefficient is the difference quantity). Measurements of the absorption and extinction coefficients due to smoke produced by the combustion of 'red phosphorous' are simultaneously obtained in a small test chamber. The same CO2 laser beam at lambda = 9.55 micron is used to produce both results. A form of aerosol spectrophone cell was used to measure the absorption coefficient while functioning as a transmission cell from which the extinction coefficient was calculated. The ratio of the absorption to extinction coefficients was then compared with estimates of the same quantities based on calculated particle sizes, the particle size estimates being obtained from characteristics of the settling process. The ratio agreed with that predicted within the experimental error. GRA

N81-10840# Army Engineer Topographic Labs., Fort Belvoir, Va. Center for Remote Sensing.
INSTRUMENTED TEST SITE FOR INFRARED BACKGROUNDS
A. O. Poulin and A. E. Krusinger Jul. 1980 14 p refs Presented at the Meeting of the IRIS Specialty Group on Targets, Backgrounds, and Discrimination, 26-27 Aug. 1980
(AD-A089152; ETL-R010) Avail: NTIS HC A02/MF A01 CSCL 17/5

A test site for the study of soil moisture and infrared backgrounds has been established at Ft. Belvoir, Va. A computer-controlled, tower-mounted radiometer (8-14 um) measures the radiance of four test plots, and a 100 channel data system measures environmental parameters. Some test results are presented. GRA

N81-10841# Avco-Everett Research Lab., Mass.
AMOS PHASE 4 ANNUAL REPORT Interim Report,

1 Jan. - 31 Dec. 1979
J. Chapman and P. McCormick Jun. 1980 194 p
(Contract F30602-78-C-0061; ARPA Order 2837; AF Proj. 2837)
(AD-A089379; AERL-TR-1043; RADC-TR-80-186) Avail: NTIS HC A09/MF A01 CSCL 17/5

This report summarizes the activities which have occurred at the ARPA Maui Optical Site (AMOS) during 1979. These activities have taken advantage of the AMOS facility which was developed by ARPA and now serves as a multi-purpose advanced optical testbed. This report contains a complete summary of the development of AMOS, a description of the assets available and summarizes the major accomplishments. GRA

N81-10842# Honeywell, Inc., Minneapolis, Minn. Technology Strategy Center.
SURVEY MIRRORS AND LENSES AND THEIR REQUIRED SURFACE ACCURACY, VOLUME 1 Final Report, 15 Sep. 1978 - 1 Dec. 1979
Jan. 1980 115 p refs
(Contract EM-78-C-04-5348; DE-AC04-78CS-05348)
(DOE/CS-35348/T1-Vol-1) Avail: NTIS HC A06/MF A01

An investigation of the optical performance of a variety of concentrating solar collectors is reported. The accuracy of reflective or refractive surfaces required to achieve specified performance goals and the effect of environmental exposure on the performance concentrators are addressed. To assess the importance of surface accuracy on optical performance, 11 tracking and nontracking concentrator designs were selected for detailed evaluation. Mathematical models were developed for each design and incorporated into a Monte Carlo ray trace computer program to carry out detailed calculations. Results for the 11 concentrators are presented in graphic form. A survey data base was established on the effect of environmental exposure on the optical degradation of mirrors and lenses. Information on environmental and maintenance effects was found to be insufficient to permit specific recommendations for operating and maintenance procedures. DOE

N81-10843# Honeywell, Inc., Minneapolis, Minn. Technology Strategy Center.
SURVEY MIRRORS AND LENSES AND THEIR REQUIRED ACCURACY. VOLUME 2: CONCENTRATOR OPTICAL PERFORMANCE SOFTWARE (COPS) USERS MANUAL Final Report, 15 Sep. 1978 - 1 Dec. 1979
Jan. 1980 223 p
(Contract EM-78-C-04-5348; DE-AC04-78CS-05348)
(DOE/CS-3548/T1-Vol-2) Avail: NTIS HC A10/MF A01

The mathematical modeling of 11 different concentrating collectors is documented and instructions are given for use of the computer code. The 11 concentrators modeled are: faceted mirror concentration; fixed mirror, two axis tracking receiver; parabolic trough collector; linear Fresnel; incremental reflector; inflated cylindrical concentrator; CPC involute reflector with evacuated receiver; CPC parabolic/involute reflector; V trough collectors, imaging collapsing concentrator; and parabolic dish collector. DOE

N81-10844# National Bureau of Standards, Washington, D.C. Center for Materials Science.
BASIC OPTICAL PROPERTIES OF MATERIALS: SUMMARIES OF PAPERS
Albert Feldman, ed. May 1980 256 p refs Presented at the Topical Conf. on Basic Opt. Properties of Mater., Gaithersburg, Md., 5-7 May 1980; sponsored in part by Optical Society of America
(PB80-202914; NBS-SP-574; LC-80-600038) Avail: NTIS HC A12/MF A01 CSCL 20F

The state of the art in the measurement of the optical properties of optical materials is discussed. The primary focus of the conference is on the measurement and theory of basic optical properties of materials in bulk, thin film and fiber form. The principal topical areas are: nonlinear optical properties; ultraviolet properties; infrared properties; graded index materials; inhomogeneous materials; properties of thin films; optical fibers, planar optical waveguides; and external influences: piezo-optics, thermo-optics, magneto-optics. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-10845 Washington Univ., St. Louis, Mo.
KINETIC THEORY OF PLASMA TRANSPORT PROCESSES WITH ARBITRARY COLLISIONALITY Ph.D. Thesis
Mohammad Hossein Shirazian 1980 175 p
Avail: Univ. Microfilms Order No. 8026306

Electron energy flux in a fully ionized gas between two parallel boundaries separated by a distance, and electron current in an homogeneous plasma subjected to an electric field were analyzed to evaluate how collisionality of a plasma can affect the plasma parameters, in particular the electron energy and particle fluxes. In the case of the steady energy transfer in a slab of ionized gas in the presence of a thermoelectric field, assuming a two sided Maxwellian and a two sided skewed Maxwellian distribution functions for electrons, four moments and six moments of the Boltzmann equation were solved for the unknown parameters in the trial distribution functions. In the case of the transient current in an homogeneous plasma subjected to an external electric field, three sets of moment equations were examined. Three types of collision models utilized the Fokker-Planck model with electron ion collisions, the Boltzmann and the BGK models with both electron ion and electron electron collisions. It is concluded that there is no apriori advantage of one moment over another, and that the accuracy of electrical conductivity in the collisional limit, derived from the moment analysis, is much better than the corresponding accuracy of thermal conductivity, irrespective of the type of the moment equations used. Dissert. Abstr.

N81-10846 Rochester Univ., N. Y.
DESIGN AND DEVELOPMENT OF AN X-RAY STREAK CAMERA FOR LASER PRODUCED PLASMA MEASUREMENTS Ph.D. Thesis
Samuel Arthur Letzring 1980 122 p
Avail: Univ. Microfilms Order No. 8023937

The need for time resolved X-ray measurements from laser produced plasmas is documented and a set of design criteria for a temporally resolving instrument is obtained. Using these criteria, an X-ray streak camera was designed and constructed that can temporally and spatially resolve X-ray emissions over a wide spectral range from a laser produced plasma of small dimensions. The design goals are a temporal resolution of 15 picoseconds, a spatial resolution of 10 microns and an X-ray spectral range from 10's of ev to 10's of kev. Finally, using this X-ray streak camera, measurements are made of the X-ray signature of a class of laser fusion targets known as exploding pusher targets. Comparisons are made between the experimentally determined signature and the theoretical signature as calculated with a one dimensional hydrodynamic code. Dissert. Abstr.

N81-10847 Wisconsin Univ. - Madison.
IDEAL MHD EQUILIBRIUM AND STABILITY OF TOKAMAKS WITH ASYMMETRIC CROSS SECTION Ph.D. Thesis
Hollis Emmet Dalhed, Jr., 1980 332 p
Avail: Univ. Microfilms Order No. 8018104

The effect of asymmetric cross section shape on the ideal MHD equilibrium and stability of Tokamak is considered with emphasis on the feasibility of incorporating such a cross section into designs of future Tokamak fusion reactors. An equilibrium configuration which incorporates a basic symmetry throughout the bulk of the plasma with a single lobed poloidal divertor seems optimum. Such an equilibrium was obtained and found to possess the stability properties of the usual symmetric shape while gaining great engineering advantages. These include a reduction of the hardware in the central region of the Tokamak and possibly significant reductions in the transformer and feedback system designs. Ellipse and ellipses with triangularity rotated about the geometric center of the figures were studied. Plasma profiles were chosen to minimize the impact of free boundary modes. The ideal MHD modes that were considered include n = 1 and n = 3 free boundary modes, n = 0 axisymmetric modes, and fixed boundary n = 3 and n yields infinity modes. The bulk of the stability calculations were carried out with a

version of the PEST linear stability code modified for asymmetry. Dissert. Abstr.

N81-10848 Wisconsin Univ. - Madison.
NUMERICAL SIMULATIONS OF ICRF HEATED TOKAMAK PLASMAS Ph.D. Thesis
Donald Thomas Blackfield 1980 258 p
Avail: Univ. Microfilms Order No. 8018100

Several computer models were used to examine ICRF heating in PLT and the conceptual Tokamak reactor NUWMAK. The complete multi-species 3 x 3 hot plasma dispersion tensor, accurate for any temperature, for ion cyclotron harmonies up to five was derived. The dispersion relation which was obtained was then coupled to a Fokker-Planck code and a one dimensional D transport code. Using a two dimensional D in velocity space, time-dependent Fokker-Planck code, in which charge exchange, radial losses, radiation and Ohmic heating were included, over 90% of the RF power was absorbed through fundamental minority damping by the protons. Dissert. Abstr.

N81-10849 Wisconsin Univ. - Madison.
PLASMA RESISTIVITY MEASUREMENTS IN THE WISCONSIN LEVITATED OCTUPOLE Ph.D. Thesis
David Allen Brouchous 1980 208 p
Avail: Univ. Mcrofilms Order No. 8015190

Resistivity measurements parallel to the magnetic field were made on gun injected plasmas ranging in density from 10 to the 9th power per cubic cm to 10 to the 12th power per cubic cm in the Wisconsin levitated octupole with toroidal and poloidal magnetic fields. The inductive electric field parallel to the magnetic field lines was calculated and was used to investigate single particle motion of trapped and circulating particles in the octupole geometry. Plasma densities and electron temperatures were measured with Langmuir probes. Ion temperatures were measured with skimmer probes which allowed local measurements in the high field bridge region. An E x B energy analyzer was developed for measuring electron velocity distributions. Current and density fluctuations were observed in the low density plasmas which exhibited anomalous resistivity. Small angle electron-wave scattering was examined in the presence of deep magnetic mirrors and was found to extend the range of applicability of Plateau resistivity determined from neoclassical transport theory.
Dissert. Abstr.

N81-10850 California Univ., Irvine.
CROSS FIELD INJECTION OF INTENSE PLASMA BEAMS INTO A TOROIDAL MAGNETIC FIELD Ph.D. Thesis
Frank Joseph Wessel 1980 296 p
Avail: Univ. Microfilms Order No. 8025636

Intense plasma beams, injected into a toridal magnetic field supplied by the University of California, Irvine Tokama, were produced by a deflagration plasma gun or an intense ion source. In the gun experiments, with a beta of 0.01, the E x B drift is observed. With a beta of 0.1, an instability is observed. With a beta of unity the plasma crosses the magnetic field by diamagnetism. In these experiments, plasma is trapped in the toroidal field for hundreds of microseconds following injection. This trapping time is consistent with the calculated drift time of plasma out of the curved magnetic system. In the ion beam experiments, the E x B drift is not observed. Instead, the beam becomes unneutralized and establishes a region of positive space charge near the magnetic field boundary. The floating potential of this region rises to the 100 KV beam acceleration voltage and in some cases, oscillates at the ion gyrofrequency. This positive space charge acts as a virtual anode by deflecting the ion trajectories. Spreading of the beam in the toroidal direction is measured and shown to be a factor explaining the absence of the E x B drift. Dissert. Abstr.

N81-10851 California Univ., Riverside.
A LABORATORY SOLAR FLARE SIMULATION USING COLINEAR BIPOLAR FLUX PAIRS Ph.D. Thesis
Gregg Allen Crockett 1980 188 p
Avail: Univ. Microfilms Order No. 8024979

The plasma physics process of magnetic field line reconnection is experimentally studied in a Double Solenoid Device (DSD). The DSD incorporates the magnetic topology postulated as necessary for a process where the magnetic fields of two bipolar sun spot group merge and through reconnection produce a solar flare. Magnetic probing and Kerr Cell photography were used to diagnose the plasma conditions to infer whether or not a solar flare could be simulated, and to test Sweet's flare hypothesis. The field topology is cylindrically symmetric and contains a semi-circular X-type neutral line and four distinct topological flux cells. Magnetic fields of up to 4 K gauss are generated by a ringing discharge from a 300 microfrequency high voltage capacitor bank through fourlinear solenoids embedded in an aluminum base plate. The solenoids are arranged in a colinear N-S-N-S array. The plasma is created by an intense induced electrical discharge through a low pressure Argon gas filling the bell jar above the solenoids. No substantial energy was stored in the induced plasma current systems, and no rapid energy release or flaring event was observed. Dissert. Abstr.

N81-10852 Colorado State Univ., Fort Collins.
ION EXTRACTION FROM A PLASMA Ph.D. Thesis
Graeme Aston 1980 95 p
Avail: Univ. Microfilms Order No. 8023845

An experimental investigation of the physical processes governing ion extraction from a plasma is presented. The screen hole plasma sheath of a multi-aperture ion accelerator system was defined by equipotential plots for a variety of accelerator geometries and operating conditions. A sheath thickness of at least fifteen Debye lengths was shown to be typical. The electron density variation within the sheath satisfied a Maxwell-Boltzmann density distribution at an effective electron temperature dependent on the discharge plasma primary-to-Maxwellian electron density ratio. Plasma ion flow up to and through the sheath was predominantly one dimensional and the ions enter the sheath with a modified Bohm velocity. Low values of the screen grid thickness to screen hole diameter ratio gave good ion focusing and high extracted ion currents because of the effect of screen webbing on ion focusing. Dissert. Abstr.

N81-10853 Michigan Univ., Ann Arbor.
NEOCLASSICAL TRANSPORT IN A FAST WAVE HEATED BUMPY TORUS Ph.D. Thesis
Robert Bruce Campbell 1980 399 p
Avail: Univ. Microfilms Order No. 8025658

Transport coefficients for ions in the core plasma of a bumpy torus were calculated analytically in both the intermediate and high collisionality regimes of operation, including the effects of a distortion in the ion velocity distribution function due to applied fast wave heating. The effects of heating at both the fundamental and second harmonic of the single ion species gyrofrequency is considered. These coefficients are incorporated into a spatially averaged (point) fluid transport model. Self-consistent power balance solutions for an ion heated bumpy torus are obtained using these coefficients and are compared with the solutions using ion transport coefficients which ignore wave heating modifications. It is concluded that the introduction of fast wave heating in a bumpy torus has no deleterious effects on the neoclassical transport of particles or energy. The ambipolarity condition, which demands that the electron and ion particle fluxes from the system be equal, has an important role in determining the impact of fast wave heating on transport. Dissert. Abstr.

N81-10854 Maryland Univ., College Park.
LOW FREQUENCY DRIFT WAVES IN SHEARED MAGNETIC FIELD Ph.D. Thesis
Chia-Lie Chang 1980 131 p
Avail: Univ. Microfilms Order No. 8025243

The stability properties of eigenmodes and other possible destabilizing influences such as the electron ion collisions and the electron temperature gradient are investigated. A velocity dependent Lorentz collision operator is used to model electron ion collisions. A numerical code is developed to solve the complicated eigenmode equations. It is found that both the drift eigenmodes and the shear Alfven eigenmodes can be driven unstable by the combined effects of electron temperature gradient and electron ion collisions. The other analysis includes the influence of magnetic shear and finite plasma beta. In both cases, it is found that sufficiently strong magnetic shear and large plasma beta can stablize the instabilities. The above theoretical model is used to investigate the stability properties of the magnetic

curvature driven mode. It is found that the growth rates of the most dangerous long wavelength perturbations are strongly reduced by sufficiently high temperature gradient. This stabilization may be explained analytically by considering the electron dynamics at the mode rational surface. Dissert. Abstr.

N81-10855 Rochester Univ., N. Y.
MEASUREMENTS OF DENSITY SCALE LENGTH DEPENDENCE OF BRILLOUIN BACKSCATTER FROM LASER PRODUCED PLASMAS Ph.D. Thesis
Robert Ellis Turner 1980 170 p
Avail: Univ. Microfilms Order No. 8023947

The fraction of the incident laser energy undergoing Brillouin backscattering from laser produced spherical plasmas with prepared density scale lengths of from 5 to 50 micrometers was measured, and found to vary from 5% to 25%. The plasmas were prepared by irradiating spherical glass microballoons with a laser repulse of adjustable intensity and timing, to simulate the effects of a long shaped pulse. The electron density profile was measured with a holographic interferometer, utilizing a fourth harmonic ultraviolet probe beam. The results are compared with non-linear theories of Brillouin scattering, with emphasis on the relative scaling of backscattering energy with density scale length. Spectral measurements (both time integrated and time resolved) were made of the backscattered light; the red shift signature of Brillouin scattering was observed. The time resolved (temporal resolution of 15 picoseconds) spectroscopic measurements reveal the existence of several spectrally discrete, temporally varying modes in the backscatter spectrum. Simple non-linear models do not appear to be able to totally account for the complex spectrum observed. Dissert. Abstr.

N81-10856# Joint Publications Research Service, Arlington, Va.
EAST EUROPE REPORT: SCIENTIFIC AFFAIRS NO. 681
28 Aug. 1980 29 p refs Transl. into ENGLISH from various European journals
(JPRS-76328) Avail: NTIS HC A03/MF A01

Various topics in plasma physics, computer science, made medical science, and electronics and electrical engineering are discussed. Abstracts of selected papers are presented in the areas of computers and automation, electronics and electrical engineering, and engineering and equipment. For individual title, see N81-10857.

N81-10857# Joint Publications Research Service, Arlington, Va.
RADIANT FLUX MEASURING ON PLASMATRONE DISCHARGE CHAMBER WALLS
K. Schovanec *In its* East Europe Rept.: Sci. Affairs no. 681 (JPRS-76328) 28 Aug. 1980 p 1-11 refs Transl. into into ENGLISH from Strojirenstvi (Prague), no. 5, May 1980 p 304-307 (For primary document see N81-10856 01-75)
Avail: NTIS HC A02/MF A01

A system for measuring radiant fluxes on the walls of a plasmatron discharge chamber at temperatures ranging along the axis of the arc between 10,000 to 11,000 Kelvins is described. The results of the measurements during selected stages of plasmatron operation characterized by electric current values of 50, 100, and 150 amperes are presented together with an explanatory commentary. The dependency of radiant flux density on the distance from the cathode and on the amount of argon passing through the discharge chamber is monitored. J.M.S.

N81-10858# California Univ. at Riverside. Plasma Physics Group.
EFFECT OF FINITE ELECTRON DRIFT VELOCITY ON THE RESONANT EXCITATION OF A NONUNIFORM PLASMA
G. J. Morales, B. M. Lamb, and E. A. Adler Jul. 1980 32 p refs
(Contract N00014-75-C-0476)
(AD-A089180; PPG-496) Avail: NTIS HC A03/MF A01 CSCL 20/9

An exact analytic solution of the external resonant excitation of a nonuniform plasma in the presence of a zero order finite electron drift is presented. The process of linear mode conversion of the long wavelength external radiation, of frequency omega, into a Langmuir wave limits the peak amplitude of the cold plasma resonance at omega = omega sub p, where omega sub p is the local electron plasma frequency. The finite electron drift alters the effective group velocity of the Langmuir wave, and thus it modifies the peak amplitude of the resonance in a significant manner. For drifts toward the overdense side an amplitude enhancement is obtained, while for drifts toward the underdense side, a severe quenching takes place. The effect is governed by a single scaled drift parameter, and significant modifications arise when its absolute value is greater than 1. GRA

N81-10859# Naval Research Lab., Washington, D. C.
COMPUTER SIMULATION STUDIES OF THE TEARING MODE INSTABILITY IN A FIELD REVERSED IRON LAYER
S. J. Marsh (Sachs/Freeman Assoc., Bladensburg, Md.), A. T. Drobot (Science Applications, Inc., McLean, Va.), and C. A. Kapetanakos (Plasma Physics Div.) 15 Sep. 1980 37 p refs (AD-A089372; NRL-MR-4297) Avail: NTIS HC A03/MF A01 CSCL 20/9

Results are reported on the computer simulation of a long, space charge neutral ion layer. The critical axial velocity spread required to stabilize the tearing mode is in agreement with the predictions of Uhm and Davidson. The growth rates of individual modes depend on the evolving profile of the distribution functions. For initially square velocity distribution profile, the code predicts growth rates that are slower by about a factor of two than those of the linear theory. In addition, it has been demonstrated that when the Budker parameter of the layer nu exceeds 1/3, a conducting wall surrounding the layer may have a destabilizing influence on it. GRA

N81-10860# Naval Research Lab., Washington, D. C. Lab. for Computation Physics.
BEAM GENERATED VORTICITY AND CONVECTIVE CHANNEL MIXING Interim Report
J. P. Boris and J. M. Picone 17 Sep. 1980 53 p refs
(AD-A089672; NRL-MR-4327) Avail: NTIS HC A04/MF A01 CSCL 20/9

Asymmetries in density and pressure gradients exist when a beam deposits energy off center in a hot gaseous channel formed by a previous beam or discharge. These asymmetries, coupled with the natural dynamics of the expanding compound channel, cause vortex filaments to be generated which propagate unabated long after motion would have ceased in a symmetric flow. This concentrated vorticity is a source of convective (turbulent) cooling of the hot channels. In this paper, we present a theory for the amount of vorticity generated as a function of asymmetry and system parameters and calibrate this theory using detailed numerical simulations. An estimate of the convective mixing time for such composite channels is constructed using the strength of the asymmetry-generated vortex filaments as a source term. GRA

N81-10861# Indiana Univ. at Bloomington. Dept. of Chemistry.
DEVELOPMENT AND CHARACTERIZATION OF A 9-mm INDUCTIVELY COUPLED ARGON PLASMA (ICP) SOURCE FOR ATOMIC EMISSION SPECTROMETRY Interim Technical Report
A. D. Weiss, R. N. Savage, and G. M. Hieftje 30 Sep. 1980 34 p refs Submitted for publication
(Contract N00014-76-C-0838; NR Proj. 051-622)
(AD-A090105; TR-28) Avail: NTIS HC A03/MF A01 CSCL 07/4

A new 9-mm (i.d.) inductively coupled plasma torch is described which supports a stable, analytically useful plasma at less than 500 watts of r.f. power and 7 L/min total argon gas flow. Detection limits, working curves and other analytical characteristics of the new device are compared with those of both a miniature (13-mm i.d.) and conventional (19-mm i.d.) ICP. Although temperatures of the new plasma are somewhat lower than those in the larger plasmas, the new system offers promise for future, miniaturized ICP instruments. GRA

N81-10862# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
A COMPUTER CODE FOR THE SPECTROSCOPIC STUDY OF LASER PRODUCED PLASMAS

L. Garifo Jun. 1979 31 p refs
(Contract CNR-77-01520.11)
(CISE-1501) Avail: NTIS HC A03/MF A01

The SPECT code for the calculation of relative ion densities in a laser produced plasma is described. The algorithm used is stable and reasonably accurate, also with large integration steps. The code is therefore suitable to be coupled to another code which describes the hydrodynamical behavior of the plasma. Results are shown for a carbon plasma and a beryllium plasma. Author (ESA)

N81-10863# Paris-Sud Univ., Orsay (France). Lab. de Physique des Plasmas.
RADIAL DISTRIBUTION OF THE ELECTRON DENSITY AND THE EXCITED ATOMS DENSITY IN A PLASMA COLUMN, PRODUCED BY A SURFACE WAVE [DISTRIBUTION RADIALE DE LA DENSITE ELECTRONIQUE ET DE LA DENSITE DES ATOMES EXCITES DANS UNE COLONNE DE PLASMA PRODUITE PAR UNE ONDE DE SURFACE]
M. Moisan (Montreal Univ.), R. Pantel (Montreal Univ.), A. Ricard, V. M. M. Glaude (Montreal Univ.), P. Leprince, and W. P. Allis (MIT, Cambridge) Jan. 1980 77 p refs In FRENCH; ENGLISH summary
(LP-176) Avail: NTIS HC A05/MF A01

The radial distribution of excited atoms in an Argon plasma, produced by a surface wave was determined. The measurements were made by recording both emission and absorption at a given wavelength as a function of the radius. Depending on the neutral gas pressure (50 to 350 mTorr) and on the surface wave frequency, the radial distribution is either flat or has a minimum on the axis and a maximum near the tube wall. A theoretical explanation is given. The same radial dependence occurs for the density of a metastable level. The radial distribution of the electrons is estimated assuming ambipolar diffusion. Author (ESA)

N81-10980# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
PLASMA WAVES PRODUCED BY AN ION BEAM: OBSERVATIONS BY THE VLF EXPERIMENT ON PORCUPINE
D. Jones *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 411-415 refs Original contains color illustrations (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N81-10864 Texas Christian Univ., Fort Worth.
THE EFFECTS OF VACANCIES ON THE THERMODYNAMIC PROPERTIES OF HARMONIC CRYSTALS: CELL CLUSTER METHOD Ph.D. Thesis
Tames Garza 1980 51 p
Avail: Univ. Microfilms Order No. 8025900

The effects on the thermodynamic properties of harmonic, monatomic crystals with first neighbor interactions due to the presence of vacancy defects were studied. A general derivation of the cell-cluster theory for harmonic systems is given. This theory is then used to calculate the zero point energy of pure crystals. The changes in the high temperature Helmholtz free energy, zero point energy and constant volume heat capacity due to the presence of a vacancy defect were also calculated. Finally, the effect on the high-temperature Helmholtz free energy due to the presence of two interacting vacancy defects in the crystal was evaluated. Numerical results were obtained for both a face-centered cubic crystal and a two dimensional triangular lattice. Dissert. Abstr.

N81-10865 Virginia Univ., Charlottesville.
CURRENT-VOLTAGE CHARACTERISTICS OF SUPERCONDUCTING WEAK LINKS IN THE HIGH CURRENT REGIME Ph.D. Thesis
Christopher Howard Galfo 1980 156 p
Avail: Univ. Microfilms Order No. 8024052

The current-voltage (I-V) characteristics of tin and niobium weak links with a variable thickness, Dayem bridge geometry were studied in the realm of high current bias. The observation of structure appearing in the dc I-V curve was conducted as a function of temperature, externally applied microwave radiation, and magnetic field. A computer-based data acquisition and control system was created to operate in conjunction with the high sensitivity analog instrumentation utilized to perform these measurements. Software that was suitable for use in several low temperature experiments was developed for real time, computer aided data collection and analysis. The microbridges that were studied all exhibited the classical dc and ac Josephson effects. In addition, at high current bias, seven classifications of structure were found in the I-V characteristics of these bridges. Microwave induced steps were observed at applied RF frequencies between 11 and 36 GHz. Dissert. Abstr.

N81-10866 Brandeis Univ., Waltham, Mass.
POSITRON ANNIHILATION ANGULAR CORRELATION STUDIES ON INTRINSIC Ge AND ON VACANCY-DEFECTED Al AND Pb Ph.D. Thesis
Michael Allen Shulman 1980 282 p
Avail: Univ. Microfilms Order No. 8024542

The results of long-slit angular correlation of positron annihilation radiation from oriented single crystals of intrinsic Ge are used to study the effects of the positron wave function and many-body enhancement on the momentum distribution. Measured distributions are compared to distributions obtained by the Compton scattering technique and to several theoretical predictions. A method is derived for the extraction of the positron effective mass in Ge from angular distributions measured at different temperatures, and when applied yields a value close to the free positron mass. A modified Wigner-Seitz type model is used to explain the results of the measured angular distribution from Al at a temperature at which all positrons annihilate from within thermally generated vacancies. The effective electron density within a vacancy and the positron localization within a vacancy are parametrized in this model. The peak height of an angular distribution in lead is measured at many temperatures between 20 C and 325 C. The trapping model describes the data well with a vacancy formation energy of 0.624 plus or minus 0.027 eV, when proper account is taken of thermal expansion effect. Dissert. Abstr.

N81-10867 Auburn Univ., Ala.
EFFECT OF GEOMETRY AND DOPING LEVEL ON THE SECOND BREAKDOWN SUSCEPTIBILITY OF SILICON-ON-SAPPHIRE DIODES Ph.D. Thesis
Edward Ray Knight 1980 270 p
Avail: Univ. Microfilms Order No. 8026113

An array of silicon on sapphire diodes with intentional irregularities, specially fabricated by Rockwell International, was tested using Sunshine's stroboscopic technique. This method exploits the decrease of optical transmittancy of silicon with increasing temperature. The dynamic growth of current filaments can be followed in many systems with a time resolution of 0.1 microsecond for pulses 10 microseconds duration and spatial resolution of 1 micrometer. Pulses were applied to the diode with constant current and constant impedance generators. The presence of P(+)n and n(+)n junction defects (spikes), corner, and radii of curvature were all found to localize current configurations near the second breakdown threshold. However, defects on the metal-p(+) and metal-n(+) junctions had no effect on current configurations. Energy, current, and voltage thresholds were correlated with diode length, width, geometry, and doping level. Spikes on the p(+)n and n(+)n junctions lowered energy failure thresholds up to 75% (more, for one group of diodes in which punch through of the n-region occurred). Spikes on the metal-p(+) and metal-n(+) junctions had no effect on failure thresholds. Dissert. Abstr.

N81-10868 State Univ. of New York at Albany.
ELECTROMAGNETIC PROPERTIES OF ALKALI METALS Ph.D. Thesis
Pratap C. Patinaik 1980 122 p
Avail: Univ. Microfilms Order No. 8024818

The general behavior of the density of states, the photoabsorption spectra, the spin susceptibility, spin density, and the

Knight-Shift were studied. A semi-Hartree-Fock Hamiltonian along with a linear combination of orthogonalized plane waves were used in obtaining the band structure. Various one electron properties are derived from it and the agreement with the experimental data is fairly good. A detailed study of the spin susceptibility was carried out and a scheme for obtaining it is indicated. The volume dependence of the spin susceptibility obtained from this scheme is in extremely good agreement with the available experimental data. The core polarization and the conduction polarization effects were included in the calculation of the spin density, Knight-Shift, and its volume dependence. In the case of the lithium and sodium the agreement with the experimental result is quite good. The value of the Knight-Shift for uncompressed potassium is in good agreement with the experimental data. The volume dependence of the spin density and Knight-Shift in potassium and the volume dependence of the Knight-Shift in rubidium are somewhat different from the observed values. Dissert. Abstr.

N81-10869 Washington Univ., Seattle.
AN X-RAY ABSORPTION STUDY OF TETRAHEDRAL SEMICONDUCTORS Ph.D. Thesis
Bruce Alan Bunker 1980 210 p
Avail: Univ. Microfilms Order No. 8026209

Tetrahedral semiconductors Ge, GaAs, ZnSe, and CuBr were chosen for study. These materials all have the same average valence, have the same diamond or zincblende crystal structures, and have very similar lattice constants. The ionicity of the chemical bonding, and therefore the charge state of the atoms, varies through the series. The extended x-ray absorption fine structure from these materials is compared with that from pure Cu, Br2 and Se, and with the calculations of Teo and Lee. Because both first and second shell data were easily isolated and data from both edges of the binary semiconductors were measured, a detailed analysis and a number of internal consistency checks were possible. The analysis shows that phase shifts between chemically dissimilar systems are transferable within distance determination errors of about 0.01 if the energy origin is treated as an adjustable parameter. This change in energy origin is generally dependent on many physical contributions which are buried in this inner potential choice. For these semiconductors, contributions from errors in the small atom approximation and inadequacies in the approximations used in the Teo, Lee calculation overshadow change state effects on the inner potential.
Dissert. Abstr.

N81-10870 Minnesota Univ., Minneapolis.
SUPERFLUID DENSITIES AND CRITICAL VELOCITIES IN SMALL CHANNELS FOR PURE He-4 AND MIXTURES OF He-4 Ph.D. Thesis
Paul Charles Schubert 1980 216 p
Avail: Univ. Microfilms Order No. 8025513

Measurements of the superfluid density fraction as a function of temperature made in 0.4, 0.1, and 0.03 micron diameter cylindrical pores in polycarbonate films are discussed for pure 4He and mixtures of 3He and 4He with 3He mole fraction X approximately - 0.2 and 0.4. A Helmholtz resonator, consisting of two chambers filled with the mixture of interest and connected through the Nuclepore superleak of interest, exhibited a temperature-dependent resonance frequency from which could be extracted the superfluid density fraction rho sub sp/rho in the pores. The depression of rho sub sp/rho below the bulk superfluid density fraction rho sub sb/rho at the same reduced temperature t is clearly seen for all pore sizes and 3He concentrations. Reduced onset temperatures t sub o are defined through the operation of fitting the data near T lambda in each case by the form rho sub sp/rho = C(t - t sub o) (0.675) where C and t sub o are allowed to float. Measurements of the low-frequency (usually 10 Hz) response of the resonator to varying levels of drive excitation provided information on the nonlinear behavior of the mass current I through the pores at high drive levels. Dissert. Abstr.

N81-10871 Pennsylvania State Univ., University Park.
SCATTERING OF LOW-ENERGY HELIUM BEAMS FROM CLEAN SURFACES OF SODIUM-FLUORIDE, LITHIUM-FLUORIDE, AND GRAPHITE Ph.D. Thesis
Gregory Neil Derry 1980 115 p
Avail: Univ. Microfilms Order No. 8024441

An examination of helium beam scattering from the basal plane of graphite and from 001 surfaces two alkali halide crystals is presented. Results are given for both 4He and 3He. Incident beam energies used range from 2.9 meV to 17.3 meV, chosen to probe the physisorption regime. Bound state energy levels are measured for 4He and 3He adsorbed on graphite, NaF, and LiF. Matrix elements of the atom-surface potential Fourier components are measured for 4He on graphite and LiF. A brief discussion of how this information is used to determine the details of the gas-atom-solid surface interaction is given. In case of 4He and 3He on graphite, comparison is made wtih thermodynamic adsorption data for submonolayer films and excellent agreement is found. Resonance lineshapes are studied for 4He scattering from LiF and from graphite as the incident angles and energy are varied. The LiF results are seen to agree well with recent theoretical predictions. For graphite, some phenomena exhibit conformance to elastic theory while others appear to contradict it. Experimental evidence that the latter are due to inelastic scattering mechanisms is presented.
Dissert. Abstr.

N81-10872 Stanford Univ., Calif.
STRUCTURAL STUDIES OF AMORPHOUS MATERIALS USING X-RAY ANOMALOUS SCATTERING Ph.D. Thesis
Paul Henry Fuoss 1980 196 p
Avail: Univ. Microfilms Order No. 8024659

X-ray scattering amplitudes can be modified by tuning the incident wavelength extremely close to a characteristic absorption edge of an atom in the sample which results in large anomalous scattering effects. Since this technique requires tuning the incident photon energy close to an absorption edge, a synchrotron radiation source greatly facilitates these measurements. The second technique involves measuring the X-ray absorption coefficient of a thin film of GeSe which is then related to the ASF by using the optical theorem and the Kramers-Kronig dispersion relationship. These techniques were applied to determine the structure of amorphous GeSe. These measurements are complicated by the extremely high fluorescent rates near the absorption edges. Data analysis techniques were developed and these data analyzed to obtain the average of the Ge-Ge and Ge-Se PDFs of amorphous GeSe. The results of this analysis support the threefold coordinated Ge models of the GeSe structure. Dissert. Abstr.

N81-10873# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
JOSEPHSON A/D CONVERTER DEVELOPMENT Annual Technical Report, 1 May 1979 - 30 Apr. 1980
C. A. Hamilton, R. E. Harris, R. L. Kautz, F. L. Lloyd, and R. L. Peterson 1 Sep. 1980 148 p refs
(Contract N00014-80-F-0017; RF62582001)
(AD-A089353; NBSSR-724-21-80) Avail: NTIS HC A07/MF A01 CSCL 09/1

This report describes the third year of an effort to demonstrate an ultra-high-speed analog to digital converter using superconducting electronics. A converter was fabricated and tested at a sample rate of 2 x 10 to the 9th power samples/second. GRA

N81-10874# Georgia Inst. of Tech., Atlanta.
GROWTH AND CHARACTERIZATION OF In(1X)Ga(X)As(Y)P (1-Y) AND GaAs USING MOLECULAR BEAM EPITAXY Annual Report, 9 Feb. 1979 - 7 Feb. 1980
D. W. Covington, E. L. Meeks, and W. H. Hicklin Mar. 1980 128 p refs
(Contract N00173-79-C-0033)
(AD-A089456; GIT-A-2291) Avail: NTIS HC A07/MF A01 CSCL 20/7

This report describes the technical work accomplished during the first year of a two year study of binary and quaternary semiconductors grown by molecular beam epitaxy. Research on GaAs materials was demonstrated during profiles for peeled film, mixer diodes and low high low, millimeter wave impatt diodes. Iron has been investigated as a potential MBE dopant for FET buffer layer applications. Although compensated layers exhibiting the Fe and line at 0.371 eV were obtained for doping oven temperatures less than but close to 1013 C at GaAs growth rates of 1.0 micron per hr, there was unintentional accumulation of iron at the outer surface reserved for the active

layer in conventional FET structures. Before initiating the study of quaternary materials, the MBE growth conditions were established for the ternary In x Ga 1-x As. Layers of the latter semiconductor grown on GaAs substrates held at 510 C showed significant changes in surface morphology and electrical properties for x greater than but close to 0.3. A cryopumped MBE system containing six oven positions has been developed for growing the quaternary In 1-x Ga x As y P 1-y which requires relatively intense beams of P molecules. Lattice matched In 1-x Ga x As y P 1-y layers have been deposited in this system on (001) GaAs substrates using ovens with Ga, In, As, and Ga P. Epitaxy was achieved. GRA

N81-10875# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.

NONEQUILIBRIUM SUPERCONDUCTIVITY IN OPTICALLY ILLUMINATED TUNNEL JUNCTIONS. Interim Report

Andrew D. Smith Aug. 1980 139 p refs

(Contracts N00014-77-C-0085; N00014-75-C-0648; Grant NSF DMR-79-04155)

(AD-A089520; TR-17) Avail: NTIS HC A07/MF A01 CSCL 20/12

In the first chapters, the question of what nonequilibrium quasiparticle energy distribution results from optical illumination on a thin film is addressed. A new technique using tunneling current voltage characteristics is developed which accurately measures the nonequilibrium quasiparticle occupation function, FE. The extremely good resolution of this technique is sufficient to compare the experimental situation to contrasting theoretical models of raised temperature T and shifted electrochemical potential MU. Data taken on the AlPb Bi tunnel junctions illuminated for this study are well described by the T model. Study of illuminated tunnel junctions lead to the discovery of a new thermoelectric effect for tunneling through oxide barriers between metals at different temperatures. The final chapters are devoted to examination of this thermoelectric effect. Two types of experiments were performed to test for the existence of this effect, with positive results. A self-consistent Rothwarf-Taylor model is presented which correctly predicts the sign, magnitude, temperature dependence and laser power dependence of the thermoelectric current. The thermoelectric effect described here appears to resolve long standing discrepancies between experimental results and theoretical predictions for a series of point contact experiments. GRA

N81-10876# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.

PHYSICAL ANALYSIS OF PROCESS-INDUCED MATERIAL DEFECTS Final Report

Klaus Graff Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 87 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-79) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18,10

The different types of impurities and defects observed in semiconductor materials are described. Methods used to detect these defects are summarized. Heavy metal impurity contents were determined after high temperature processing in various atmospheres and after silicon epitaxy. Pulled and floating zone silicon crystals were investigated after annealing, special attention is given to oxygen and carbon contents. Variations were observed in the lattice constants of silicon epitaxial layers. The results obtained with silicon after electron bombardment are presented. A method for detecting dislocations in GaP crystals is reported. Author (ESA)

N81-10877# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Angewandte Festkoerperphysik.

TRAP ANALYSIS IN SEMICONDUCTORS WITH THE CORRELATION METHOD Final Report

Max Schulz, Helmut Lefevre, and Franz Pohl Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 170 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.

(BMFT-FB-T-79-117) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 35,70

A Deep Level Transient Spectroscopy (DLTS) method with a high trap detection sensitivity (resolution better than 10 to the 10th power traps per cu cm is described. A double electronic correlation is performed on the measured transient capacitance. It is possible to determine trap profiles separately for each level. More than three hundred trap spectra were measured. A large number of levels were determined for neutron transmutation-doped silicon after radiation damage annealing. Defect centers were found in electron irradiated silicon. Deep crystals were analyzed to determine characteristic levels of specific contaminants. Doping profiles were determined for GaAs on epitaxial material. It was possible to distinguish between grown-in defects and interface contaminants. Author (ESA)

N81-10878# Consortium fuer Elektrochemische Industrie G.m.b.H., Munich (West Germany).

PREPARATION AND DOPING OF EPITAXIAL LAYERS OF SILICON CARBIDE Final Report

Hartmut Seiter Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 44 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-125) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9,25

Layers of silicon carbide were deposited from the vapor phase on a single crystal silicon substrate. The vapor phase consists of a mixture of SiCl4 or SiH4 with hydrocarbons and hydrogen. The doping level was raised to about 0.1 Ohm cm by the addition of PBr3 during the deposition. Addition of boron compounds, e.g., BC13 or B2H6 to the vapor phase did not result unambiguously in p-type material. Examination of the SiC layers by X-ray diffraction showed that it is possible to get epitaxial growth on the /111/ surface of Si. The layers were up to 5 microns thick. The epitaxial layers consist preferentially of the hexagonal SiC polytype. The photoluminescence spectral distribution of these SiC layers is similar to that of a single crystal of SiC, but the efficiency of the photoluminescence is relatively low. Author (ESA)

N81-10879# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).

STUDY OF GROWTH CONDITIONS AND ELECTRONIC PROPERTIES OF DOUBLE GaAlAs HETEROJUNCTIONS PREPARED IN THE VAPOR PHASE FOR OPTOELECTRONIC APPLICATIONS Final Report [ETUDE DES CONDITIONS DE CROISSANCE ET DES PROPRIETES ELECTRONIQUES DES DOUBLES HETEROJUNCTIONS AU GaAlAs ELABOREES EN PHASE VAPEUR POUR APPLICATIONS OPTOELECTRONIQUES]

J. P. Andre and J. Hallais 6 Jul. 1979 76 p refs In FRENCH

(Contract DGRST-77-7-0952)

(LEP-79.522-SME-555-B) Avail: NTIS HC A05/MF A01

Electroluminescence techniques were employed to investigate the variations in electronic quality with growth conditions. The quality of GaAs prepared with organometals was found to be little dependent on growth conditions. The quality of the GaAlAs produced was found to be highly dependent on growth conditions. Growth conditions were defined to produce high quality GaAlAs high depositing temperature; high group 5/group 3 element ratio; n-type doping with selenium; and p-type with zinc. These criteria enabled double electroluminescent heterojunctions to be realized. Author (ESA)

N81-10880 California Inst. of Tech., Pasadena.

THE CHEMICAL STRUCTURE OF METAL/SEMICONDUCTOR INTERFACES AS DETERMINED BY X-RAY PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis

Paula Jean Grunthaner 1980 212 p

Avail: Univ. Microfilms Order No. 8021679

The chemical nature of transition metal/silicon interfaces was investigated using X-ray photoelectron spectroscopy and Rutherford backscattering spectroscopy. The Ni/Ni2Si, Si/Ni2Si, and Ni/Si transitional regions were examined. The effect of oxygen impurities on the Ni/Ni2Si interface was studied using ion implantation. Preliminary results on the Pd/Pd2Si and Pt/Pt2Si interfaces are presented and contrasted to the Ni system. A technique for studying silicide/silicon and silicide/metal interfaces was developed which exploits the exponential attenuation of photoemission intensities to dynamically monitor the advancing

planar silicide growth front during the in situ growth of the silicide. These interfacial experiments demonstrated that the local environment of the Ni atoms at the Si/Ni2Si interface is more Si-rich than that found for Ni in Ni2Si. The chemical nature of the Ni/Si interface as a function of the substrate temperature was also examined. Dissert. Abstr.

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N81-10881 Washington Univ., St. Louis, Mo.
THERMODYNAMIC EQUILIBRIUM IN THE CHEMICAL SYSTEM NH3-H2O-SO2 Ph.D. Thesis
Larry Douglas Erickson 1980 237 p
Avail: Univ. Microfilms Order No. 8026229

Three important aspects of the chemical system ammonia water sulfur dioxide are investigated. The liquid phase equilibria are examined obtaining experimental data for the partial pressures of NH3 and SO2, and a thermodynamically rigorous model of the system is developed. Experimental work using ultraviolet spectrophotometry established that the metabisulfite ion is an important constituent of sulfite systems. A device was built for obtaining partial pressure data, allowing fine temperature control and thorough mixing of the liquid phase. A mathematical model of the system was developed and a FORTRAN program was written. The Guggenheim approach to ionic activity coefficients was expanded to include potential interactions between ionic species and neutral molecules and incorporated in the model. Dissert. Abstr.

N81-10882 Arkansas Univ., Fayetteville.
AN ANALYSIS OF THE IRREVERSIBLE THERMODYNAMICS MODEL FOR COUPLED HEAT AND MOISTURE TRANSPORT PHENOMENA IN UNSATURATED POROUS MEDIA Ph.D. Thesis
Rajesh Jethalal Parikh 1979 124 p
Avail: Univ. Microfilms Order No. 8026052

The irreversible thermodynamics based model for the description of coupled heat and moisture transfer was analyzed. The transport coefficients appearing in the model equations were independently determined and the equations were numerically integrated to predict temperature and moisture content profiles for a closed system of water unsaturated glass beads. An experimental investigation of the moist glass beads medium provided measurements of steady state profiles of local temperatures and moisture content. These data, when compared with model predictions, indicated the validity of the irreversible thermodynamics approach. The coupling coefficient relating thermal gradients to moisture flux was found to be strongly moisture dependent. The coupling coefficient which relates moisture content gradient to heat flux was found to be extremely small, and the heat flux associated with the moisture content gradient proved to be negligible. Dissert. Abstr.

N81-10883 Rochester Univ., N. Y.
A NONPERTURBATIVE STUDY OF ENERGY LEVELS. 1: QUANTUM ANHARMONIC OSCILLATORS AND 2: SIMPLE QUANTUM MODELS WITH VARIABLE BOUNDARY CONDITIONS Ph.D. Thesis
Donald Benton MacMillen 1980 247 p
Avail: Univ. Microfilms Order No. 8023939

The spectrum of energy levels as a function of the interoscillator coupling is examined. Several rapidly convergent algorithms were developed for the calculation of the energy levels of anharmonic oscillators, and energy level tables and graphs are presented. A semiclassical JWKB analysis is applied to the anharmonic oscillator systems when n, the quantum number, becomes large. In one dimension, this analysis leads to expressions for the energy levels that are seen to be accurate when compared to the results of the previously derived algorithms. In two dimensions the semiclassical behavior is examined by the use of formula, due to Titchmarsh, for the asymptotic distribution of eigenvalues. For the boundary perturbation problem, a variational method is employed to calculate the energy levels of a hydrogen atom in the presence of an infinite potential on a plane as a function of the proton's distance from that plane. The energy levels are continuous as a function of R, the perpendicular distance of the proton to the plane, and exhibit several level crossings besides those expected at R = 0. Dissert. Abstr.

N81-10884# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Corp.
AN IRREVERSIBLE THERMODYNAMICS MODEL FOR GRAPHITE SUBLIMATION IN INTENSE RADIATION ENVIRONMENTS Final Report
R. L. Baker 15 Sep. 1980 37 p refs
(AD-A089405; TR-0080(5990-20)-1; SD-TR-80-62) Avail: NTIS HC A03/MF A01 CSCL 07/4

A model for the phase change behavior of graphite when exposed to a high external radiation heat flux has been developed in order to examine solid-gas nonequilibrium effects. The usual Knudsen-Langmuir type model is extended to one which allows both pressure and temperature discontinuities at the ablating surface. Calculated results indicate a relatively constant effective heat of ablation. However, major uncertainties are shown to remain regarding individual carbon species concentrations and the input energy required for melting. A unique feature of the irreversible thermodynamics model is the prediction of gas phase supersaturation when JANNAF thermochemical data is utilized. GRA

N81-10885# Wisconsin Univ. - Madison. Mathematics Research Center.
NEW APPLICATIONS OF GENERALIZED CURVES, PARTICULARLY IN PHYSICS
L. C. Young May 1980 22 p refs
(Contracts DAAG29-75-C-0024; DAAG29-80-C-0041)
(AD-A089610; MRC-TSR-2067) Avail: NTIS HC A02/MF A01 CSCL 12/1

The traditional assumptions of infinitesimal smoothness, implicitly made in various applied topics, do not agree with what is observed at microscopic and smaller dimensions. Mathematical models closer to what actually occurs, are made possible by the theory of generalized curves, and by the matching up and resonance of the infinitesimal patterns they generate. Phenomena hitherto not fully accounted for, may be partly due to such generalized patterns in stress lines of bridges, streamlines of shock waves, and rays of light. In relativistic quantum physics, generalized curves appear on account of the indefiniteness of the metric, and the infinitesimal zigzagging corresponds to successive emission and absorption of radiation. The Nowosad theory, a preview of which is given here, accounts in this way for the elementary particles in a logical manner, and provides at the same time de Broglie's Pilot Wave and the quantum potentials of Bohm and Vigier. Moreover such things as the Pauli exclusion become theorems. The theory makes uses of singular integrals and of reduced quaternion-valued analytic functions. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

No abstracts in this category.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N81-10886 Southern Methodist Univ., Dallas, Tex.

DOCUMENT RETRIEVAL BASED ON INFORMATION STRUCTURE PROPERTIES *Ph.D. Thesis*

Leslie L. Miller 1980 128 p

Avail: Univ. Microfilms Order No. 8025539

A document set is placed in a data space by preprocessing the text to create the appropriate information structure. The special properties of the structure are used to measure the *closeness of the documents to the retrieval* query. The use of threshold measures in this determination of the relevant documents is discussed. Examples of graph and partition models are *presented to illustrate the retrieval techniques.* The term weighting schemes used in testing the models are reviewed. The possible extension of the retrieval *concepts to a database machine is evaluated.*

Dissert. Abstr.

N81-10887 Rochester Univ., N. Y.

A VERY HIGH LEVEL LANGUAGE AND OPTIMIZED IMPLEMENTATION DESIGN FOR RELATIONAL DATABASES *Ph.D. Thesis*

Jonathan Edward Shopiro 1980 203 p

Avail: Univ. Microfilms Order No. 8023941

Theseus, a programming language for manipulating relational databases, and a design for a system for implementing programs in Theseus on a computer are described. Theseus is a *very high level language* which has relations and a-sets, a generalization of records, as primitive types. It has a number of operators which can be applied to its objects, *most important of which* is an unordered for statement that gives tuple by tuple access to relations. Theseus is powerful enough to express any *reasonable function on relations. The design for a compilation* system for Theseus includes a compiler/program transformer which carries out an extended dialog with a database retrieval *planner. The compiler carries out a variety of* program transformations while the retrieval planner finds efficient access paths to the given database to satisfy the requirements of each transformation. It also estimates the expected cost and size of each retrieval. The compiler uses this information to evaluate the overall cost of each transformation of the input program and outputs the least expensive of them. The compiler has no access to the physical structure of the database. Dissert. Abstr.

N81-10888 Arkansas Univ., Fayetteville.

A MANAGEMENT/RESEARCH INFORMATION SYSTEM DESIGN FOR ARCHEOLOGICAL RESOURCES Ph.D. Thesis

Sandra Clements Scholtz 1980 184 p

Avail: Univ. Microfilms Order No. 8026035

The design of a management information system for archeological resources is described. The design of the information system includes the determination of the nature of the component data bases and the data categories, the definition of forms for data collection, the definition of effective data base file structure, the definition of formats of system reports, the determination of the necessary geographic information to be extracted from maps by digitizing, and the description of the necessary software and hardware to process, retrieve, aggregate, and report the information in the component data bases. The site *records of the Arkansas Archeological Survey were* examined in the design of this information system, referred to as Archeological Information Management (AIM). The AIM *system includes data bases for information about* archeological sites and auxiliary data bases which contain information about survey projects designed to look *for sites, streams, soil associations, specific soil types, and USGS* Quadrangle maps for the state. Site inventory information is stored in two forms, a highly coded fixed format form accessible *through the Statistical Analysis System, and a direct access form* accessible through a storage and retrieval system. Dissert. Abstr.

N81-10889# *Defense Technical Information Center, Alexandria,* Va.

PROCEEDINGS OF 23D MILITARY LIBRARIANS WORKSHOP: *MILITARY SPECIAL LIBRARIES IN 1990*

Olga G. Luchaka, (ed.), Barbara P. Gladd, (ed.), Gail B. Martens, (ed.), and Loretta M. Brown, (ed.) Jun. 1980 401 p *refs Workshop held at Alexandria, Va., 3-5 Oct. 1979*

(AD-A086300; DTIC/TR-80/4) Avail: NTIS HC A18/MF A01 CSCL 05/2

More than 150 military librarians participated in six individual task groups, consisting of a number of general sessions. The *respective discussion topics assigned to these groups were* contracting out library services, closing the card catalog, new products and services, managing libraries, steady state (no growth) *libraries, and basic planning for library automation. The work*shop general sessions, consisting of lecture presentations followed by questions and informal discussions, were interspersed in the *program with task group meetings. Each task group had a full* schedule of speakers on its specific topic to assist group members to define and propose solutions to future problems likely to *confront military special libraries in the 1990s.* Emphasis was placed on the impact of new technology on the changing role of the library, its relationship to future user needs, and *library management in the probable work situation in the 1990s.* The ability of librarians and, more importantly, of users to cope with the changes *foreseen was a major interest. The workshop* concluded with task group summaries presented by the group leaders. R.K.G.

N81-10890# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

DATA BASE ACCESS IN *COMMUNICATIONS, COMMAND,* CONTROL AND INTELLIGENCE COMPUTER NETWORKS Final Report, Feb. 1979 - Feb. 1980

Thomas C. Bartee and O. Peter Buneman Jun. 1980 95 p refs

(Contract MDA903-79-C-0320)

(AD-A089153; AD-E500200; IDA-P-1489; IDA/HQ-80-22364) Avail: NTIS HC A05/MF A01 CSCL 09/2

Shared resources in C3I systems require either standard query languages or translators. A standard for C3I data base structures *is needed to facilitate future system developments. The transmis*sion control protocol is advancing and front ends are required for system usage. GRA

N81-10891# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. d'Informatique.

DATA AND INFORMATION ANALYSIS [ANALYSE DE DONNEES ET INFORMATION]

Christine Nora Jun. 1979 25 p refs In FRENCH Presented at AFCET-INFORSID Sem., Pont-a-Mousson, France, 18-19 Jun. 1979

(ENST-C-79022) Avail: NTIS HC A02/MF A01

Various processes employed to analyze and characterize multidimensional data are outlined. The principal underlying philosophy is exposed and the main methods used are given, including: classification of data (i.e., quantitative or qualitative); Charnoff; polygonal and Bertin's methods; classification and segmentation. Some concrete examples are treated involving classification and recognition problems. Author (ESA)

N81-10892# Illinois Univ. at Urbana-Champaign. Graduate School of Library Science.

THE IMPACT OF A PAPERLESS SOCIETY ON THE RESEARCH LIBRARY OF THE FUTURE Final Report, Sep. 1978 - Dec. 1979

F. W. Lancaster, Laura Drasgow, and Ellen Marks Feb. 1980 221 p refs
(Grant NSF DSI-78-04768)
(PB80-204548) Avail: NTIS HC A10/MF A01 CSCL 05B

A Delphi study, conducted with representative samples of publishers, librarians and technologists, confirmed the probable conversion from print on paper publishing to electronic publishing in the case of indexing/abstracting services, scholarly journals, reference books, patents, technical reports, standards and specifications, and dissertations. Technological developments likely to affect publishing and other information transfer activities in the future are reviewed and the characteristics of a completely paperless communication system are outlined. A scenario depicting the functions of the research library in the year 2001 is presented and discussed. The scenario predicts the decline of the library as an institution but an increase in the importance of the information professional. GRA

N81-11006# Joint Publications Research Service, Arlington, Va.
NEW CENTRAL S/T INFORMATION SERVICE LAUNCHED
In its West Europe Rept.: Sci. and Technol., no. 4 (JPRS-74613) 21 Nov. 1979 p 85-91 refs Transl. into ENGLISH from Le Progress Technique (Paris), no. 14/79 p 19-21 (For primary document see N81-11001 01-99)
HC A06/MF A01

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N81-10893 Kansas Univ., Lawrence.
CHARACTERISTICS OF AN AERATED LAGOON FOR MUNICIPAL WASTEWATER TREATMENT Ph.D. Thesis
Miryoussef Norouzian 1980 241 p
Avail: Univ. Microfilms Order No. 8026725

A multicell aerated lagoon system treating domestic wastewaters with emphasis on changes in nutrients which affect algal growth in receiving waters was studied. Two 3 cell aerated lagoons were constructed and operated for one year. The aerated lagoon had a 24 hour completely mixed cell followed by a 4 day partially mixed cell and a 9 day cell for solids separation. A wood media, submerged tower was constructed in one pilot unit to determine the usefulness of additional surface in retaining the microbial solids. Data indicated that the 14 day aerated lagoon could produce a high quality effluent as far as BOD5 and suspended solids reductions of the initial wastewaters were concerned. The soluble BOD5 was removed in the 24 hour aerated cell while the suspended BOD5 was removed in the first and second cells. Approximately 40 percent of the nitrification reaction occurred in the 24 hour cell during summer operations with nitrification being completed in the second cell.

Dissert. Abstr.

N81-10894 Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
EXAMPLE OF A POLICY FOR DEVELOPING SPACE TECHNOLOGY SPIN-OFFS IN OTHER FIELDS [EXEMPLE D'UNE POLITIQUE DE VALORISATION DE RETOMBEES TECHNOLOGIQUES SPATIALES DANS D'AUTRES DOMAINES]
Didier G. Compard Paris 1980 35 p In FRENCH Presented at Intern. Colloq. on Econ. Effects of Space and Other Adv. Technol., Strasbourg, Apr. 1980
(SNIAS-801-422-108) Avail: NTIS HC A03

Spin-offs fall into two categories: direct products available when satellites are put into orbit with applications in such areas as Earth communication stations, computer terminals, television stations and indirect products with specific applications in special industrial or commercial sectors. Spin-offs related to the oil, nuclear, and solar energy industries are presented together with other applications in medicine, heavy load braking systems (airplanes, tanks, etc.), chemical products, vehicle shielding, gas storage, magnetic bearings, gyroscopic energy storage systems, safety systems, and special materials. Author (ESA)

N81-10895*# Rensselaer Polytechnic Inst., Troy, N. Y.
ELECTRONIC AND SOFTWARE SUBSYSTEMS FOR AN AUTONOMOUS ROVING VEHICLE M.S. Thesis
Graham A. Doig Oct. 1980 68 p refs
(Contract JPL-954880; Grant NsG-7369)
(NASA-CR-163668; RPI-TR-MP-76) Avail: NTIS HC A04/MF A01 CSCL 13F

The complete electronics packaging which controls the Mars roving vehicle is described in order to provide a broad overview of the systems that are part of that package. Some software debugging tools are also discussed. Particular emphasis is given to those systems that are controlled by the microprocessor. These include the laser mast, the telemetry system, the command link prime interface board, and the prime software. A.R.H.

N81-10896# International Energy Associates Ltd., Washington, D.C.
APPLICATION OF SPACE AND AVIATION TECHNOLOGY TO IMPROVE THE SAFETY AND RELIABILITY OF NUCLEAR POWER PLANT OPERATIONS Final Report
Apr. 1980 271 p refs
(W-31-109-eng-38)
(DOE/TIC-11143) Avail: NTIS HC A12/MF A01

Various technologies that have been developed and utilized by the aerospace community are examined, particularly the National Aeronautics and Space Administration (NASA) and the aviation industry. Potential for contributing to improved operational safety and reliability at commercial nuclear power plants of the type being built and operated in the United States today is emphasized. Transfer and application of technology developed by NASA, as well as other public and private institutions, may well help to decrease the likelihood of reactor accidents in the future. DOE

N81-10897# Booz-Allen and Hamilton, Inc., Bethesda, Md. Transportation Consulting Div.
RAMP DESIGN PARAMETERS FOR LOW-FLOOR TRANSIT BUSES Final Report
Apr. 1980 134 p refs
(Contract DOT-UT-70032)
(PB80-196546; UMTA-MD-06-0024-80-1; BP-79-002) Avail: NTIS HC A07/MF A01 CSCL 13F

Reducing transit coach travel barriers to transportation handicapped individuals is a key design goal of the Transbus development program. Accessibility design parameters for transportation handicapped individuals on ramp equipped Transbus coaches is described. Physically handicapped volunteers tested

a full scale mock-up of a Transbus coach. The participants had various physical disabilities, although emphasis was placed on using wheelchair-bound individuals, as their configuration was believed to present a more difficult accessibility problem. Evaluation of the various parameters was accomplished by recording times to conduct the maneuvers, recording participants' and bystanders' reactions, and noting any problems encountered during the maneuvers. GRA

N81-10898# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
ELECTRONIC ENGINE CONTROLS: AVAILABILITY, DURABILITY, AND FUEL ECONOMY EFFECTS ON 1983 AND LATER MODEL YEAR LIGHT-DUTY TRUCKS
Thomas Nugent, Zachary Diatchum, and Timothy Cox Jun. 1980 19 p refs
(PB80-199185; EPA-AA-SDSB-80-11) Avail: NTIS HC A02/MF A01 CSCL 13F

The application of microprocessor technology to optimize the functions of the internal combustion engine is discussed. Passenger car model years 1980 and 1981 experienced the widespread introduction of electronic engine controls of varying degrees of complexity. These controls hold the promise of lowering engine emissions and raising engine fuel economy through the optimization of the combustion processes at all engine operational conditions. The potential of this technology for use in the future light duty truck fleet is examined. The implications of this technology on fleet fuel economy, in conjunction with the more stringent emission standards in 1983, are exmained along with projections as to the future availability and durability of these microprocessors and their associated engine sensors. GRA

N81-11005# Joint Publications Research Service, Arlington, Va.
NEW MEASURES IN FAVOR OF INNOVATION
In its West Europe Rept.: Sci. and Technol., no. 4 (JPRS-74613) 21 Nov. 1979 p 79-84 refs Transl. into ENGLISH from Le Progress Technique (Paris), no. 14, 1979 p 7-9 (For primary document see N81-11001 01-99)
Avail: NTIS HC A06/MF A01

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-10899 Washington Univ., Seattle.
DIFFUSION AND CHEMICAL ABUNDANCES IN WHITE DWARF ATMOSPHERES Ph.D. Thesis
David Owen Muchmore 1980 176 p
Avail: Univ. Microfilms Order No. 8026280

Calculations of the rate of diffusion of chemical elements through white dwarfs are presented. Multicomponent flow equations are used to describe fully the interactions of various components of the gas. Transport coefficients are evaluated numerically to avoid the dilute gas approximations which have been used previously. The diffusion calculation is coupled with the calculation of stellar structure in a self-consistent manner. The diffusion timescales found are always shorter than evolutionary timescales for the white dwarfs. The results for timescales are somewhat longer than most of the analogous results obtained by others. Heavy elements cannot remain in the atmosphere of a white dwarf long. In a hydrogen rich white dwarf atmosphere with effective temperature 12000 K for example, some metals can be depleted by diffusion in a span of 10 years. The impurities observed in white dwarfs must be indicators of current or recent processes of enrichment. No indication that the material flowing downward into a white dwarf would accumulate sufficiently in any layer of the star to significantly affect the star's structure is found. Dissert. Abstr.

N81-10900 Harvard Univ., Cambridge, Mass.
U-R COLOR DISTRIBUTIONS FOR THE POPULATION CONTENTS OF RICH CLUSTERS OF GALAXIES Ph.D. Thesis
Walter Lawrence Rice 1980 202 p
Avail: Univ. Microfilms Order No. 8024813

The (U-R) colors, obtained using photographic photometry, are presented for galaxies located in the central Mpc regions of six nearby rich clusters and the centrally condensed rich clusters A586 ($z = 0.172$) and A801($x = 0.192$). The nearby cluster sample includes the typical cD clusters A1656 (Coma) and A2199 and the typical spiral rich clusters A1228 and A2151 (Hercules). The techniques developed to search for object images, sort out the galaxy images, measure aperture magnitudes, and calculate total magnitudes are outlined. Galxies in the central regions of the nearby clusters brighter than $Mg = 20$ were classified by visual inspection and these classifications were used to separate each cluster color-magnitude diagram into a color region populated mostly by elliptical and SO galaxies and a bluer color region populated mostly by spiral galaxies. The correlation between the spiral galaxy content and the blue galaxy content found for the nearby clusters was used to analyze the color distributions for the two distant clusters. Dissert. Abstr.

N81-10901*# California Inst. of Tech., Pasadena.
THE FORMATION OF A T TAURI STAR: OBSERVATIONS OF THE INFRARED SOURCE IN L 1551
Stella Harris (Queen Mary College, London) and Charles Beichman 1980 19 p refs
(Grant NGL-05-002-207)
(NASA-CR-163667) Avail: NTIS HC A02/MF A01 CSCL 03A

The 5 to 25 micron observations show that an object previously discovered at 2.2 microns (IRS 5) within the densest part of the L1551 dark cloud is a strong source of radiation from grains as cool as 230 K. The energy distribution resembles that of infrared objects embedded within other molecular cloud cores, but implies a total solar luminosity of only 30. The luminosity of the source and its proximity to other T Tauri stars suggests that it is a 1 to 2 solar mass pre-main sequence star still swaddled within the L1551 cloud. The radio and optical evidence for mass motions around IRS 5 may mean that IRS 5 has been flaring in FU Ori-type eruptions within the last 1000 years. M.G.

N81-10902# Cambridge Univ. (England). Inst. of Astronomy.
[ACTIVITIES OF THE INSTITUTE OF ASTRONOMY, 1978 TO 1979] Annual Report
1980 36 p refs
Avail: NTIS HC A03/MF A01

Observational work on quasars and galaxies, stars and star clusters was reviewed. Theoretical studies were continued in galaxy clustering, galaxy formation, and cosmology, galactic structure and dynamics, as well as on star clusters, stellar structure and evolution, galactic nuclei, compact objects, the Sun and solar system. Improvements in instrumentation are listed.
Author (ESA)

N81-10903# Joint Publications Research Service, Arlington, Va.
USSR REPORT: SPACE, NO. 7
8 Oct. 1980 46 p Transl. into ENGLISH from various RUSSIAN journals
(JPRS-76578) Avail: NTIS HC A03/MF A01

Various aspects of the U.S.S.R. space program are highlighted. Specific topics covered include operation of a spaceborne radio telescope, studies in aerospace medicine, developments in spacecraft control technology, and application of remote sensing data. For individual title, see N81-10904.

N81-10904# Joint Publications Research Service, Arlington, Va.
THE KRT-10 SPACE BORNE RADIO TELESCOPE ON THE

SALYUT-6
N. S. Kardashev, A. I. Savin, M. B. Zakson, A. G. Sokolov, and K. P. Feoktistov *In its* USSR Rept.: Space no. 7 JPRS-76578 8 Oct. 1980 p 1-15 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow), no. 4, Jul. - Aug. 1980 p 2-9 (For primary document see N81-10903 01-89)
Avail: NTIS HC A03/MF A01 CSCL 03A

The design of the KRT-10, a spaceborne radio telescope, is discussed including its launch into orbit, its deployment, and its placement in operation on the Salyut 6. Experience gained in radio science and results of astrophysical and geophysical studies performed with the radio telescope are emphasized. J.M.S.

N81-10937# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ASTRO 4: A SOUNDING ROCKET PROGRESS OF THE X-RAY ASTRONOMY
R. Henkel and H. Pechstein *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 147-153 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10983# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
SEARCH OF A CYCLOTRON LINE AT 70 keV FROM CRAB NEBULA
P. Ubertini, A. Bazzano, C. D. LaPadula, V. F. Polcaro, and R. K. Manchanda (Tata Inst. of Fundamental Research, Bombay) *In* ESA European Rocket and Balloon Programs and Related Res. Apr. 1980 p 431-434 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10984# Liege Univ. (Belgium). Inst. d'Astrophysique.
AN IMAGE PHOTON COUNTING SYSTEM FOR SPACE ASTRONOMICAL OBSERVATIONS
S. Gardier, C. Jamar, J. P. Macau, and A. Monfils *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 435-443 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10985# Bonn Univ. (West Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung.
SPECTROPHOTOMETRIC INVESTIGATIONS OF He-I/II RESONANCE EMISSIONS WITH A ROCKET-BORNE MULTISENSOR RESONANCE CELL INSTRUMENTATION
G. Lay, H. J. Fahr, and C. Wulf-Mathies (Tuebingen Univ., West Germany) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 445-448 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10986# Bonn Univ. (West Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung.
INTER-ZODIAK: A HIGH-APOGEE ROCKET EXPERIMENT FOR THE OBSERVATION OF DUST-GENERATED NEUTRALS IN THE SOLAR VICINITY
H. J. Fahr, H. W. Ripken, and G. Lay *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 449-451 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10987# Queens Univ., Belfast (Northern Ireland). Dept. of Pure and Applied Physics.
UNITED KINGDOM PROGRAMS IN BALLOON ULTRAVIOLET ASTRONOMY
B. Bates, W. Brown-Kerr, D. L. Giaretta, J. A. Mcquoid, A. Boksenberg (University College, London), M. Pettini (University College, London), W. A. Towlson (University College, London), and B. Y. Welsh (University College, London) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 453-460 refs Sponsored by the UK Science Research Council and the Ministry of Education of Northern Ireland (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

N81-10988# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
EUROPEAN ACTIVITIES IN BALLOON-BORNE INFRARED ASTRONOMY
S. Drapatz *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 461-468 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-10905 State Univ. of New York at Albany.
NEUTRON STAR EVOLUTIONARY SEQUENCES Ph.D. Thesis
Martin Brian Richardson 1980 577 p
Avail: Univ. Microfilms Order No. 8024817

Evolutionary sequences for a nonrotating, nonmagnetic neutron star were calculated using a fully general relativistic, spherically symmetric quasistatic stellar evolution code. The equation of state used consists of a finite temperature formulation in the outer crust of the neutron star and a zero temperature formulation supplemented by finite temperature corrections in the inner crust and core. The crustal matter was found to go through a first order phase transition at a value of gamma approximately equals 155, where gamma is the ratio of Coulomb to thermal energy. The effects of superfluidity on the heat content of the star was included, as well as the effects superfluidity has on the neutrino rates due to the modified URCA and nucleon-nucleon bremsstrahung processes. In agreement with previous calculations, emission of neutrinos from a postulated pion condensate utterly dominates the cooling of the stars.
Dissert. Abstr.

N81-10906 Arizona Univ., Tucson.
CHEMICAL ABUNDANCES AND PHOTOMETRIC PARAMETERS IN THE BULGES OF SPIRAL GALAXIES Ph.D. Thesis
Todd Allan Boroson 1980 179 p
Avail: Univ. Microfilms Order No. 8025225

Metal abundances in the nuclei of spiral galaxies were measured. The line strength variations due to metallicity changes were distinguished from those due to a filling in of the lines by the continuum from a young population. This was accomplished by measuring absorption line indices for Mg b and for a CN band at lambda 3880. Nuclear spectra of twenty ellipticals, obtained with a reticon detector, show these two indexes to be well correlated for pure old populations; models including the effects of young stars show a very different trajectory for age effects. A procedure was thus defined for determining the metallicity of the population and the fraction of light coming from the young component, and this procedure was applied to observations of 25 spiral galaxies. A comparison of the results of this analysis with detailed population syntheses for six galaxies confirmed the correctness of the procedure. Dissert. Abstr.

N81-10907 Michigan Univ., Ann Arbor.
VELOCITY DISPERSIONS IN SPIRAL GALAXIES Ph.D. Thesis
Bradley Charles Whitmore 1980 140 p
Avail: Univ. Microfilms Order No. 8025804

Velocity dispersions were determined using spectra obtained at the 1.3 telescope of McGraw-Hill Observatory with a 2000 channel intensified Reticon scanner. A Fourier quotient method of estimating velocity dispersions was employed, with typical uncertainities of about 10%. The spheroidal bulges of spiral galaxies obey the same relationship between luminosity and volocity dispersion that was found in elliptical galaxies, but with dispersions smaller by 15% at a given absolute magnitude. Possible errors in the determination of the bulge luminosities, and uncertainties in estimates of sigma due to contamination from the disk, dictate a cautious interpretation of this gap. Using a smaller sample of SO galaxies, the relationship holds for the spheroidal bulge component of these galaxies, with essentially no gap with the ellipticals. The spheroidal components of elliptical,

SO, and spiral galaxies are dynamically similar, and have probably undergone similar evolutionary histories. Dissert. Abstr.

N81-10908 Maryland Univ., College Park.
THE EFFECTS OF CNO ABUNDANCE VARIATIONS AND DETAILED BOUNDARY CONDITIONS ON THE EVOLUTION OF GLOBULAR CLUSTER RED GIANTS Ph.D. Thesis
Cynthia Yan-Oi Cheung 1980 105 p
Avail: Univ. Microfilms Order No. 8025245

The CNO abundances of globular clusters have been suggested as a primary distinguishing second parameter in cluster classification, aside from the usual metal abundance parameter. Evolutionary tracks of 0.8 MO Population 2 stars of four different combinations of CNO and metal abundances (called Rood 1, 2, 3, and 4 mixtures) were computed using: grey diffusion approximated atmospheres: detailed line blanketed LTE model atmospheres with convention and molecular opacities as outer boundary conditions. Hydrogen burning via CNO cycle was handled in detail to take into account non-equilibrium effects. The resulting track morphology showed that the CNO abundances exert their major influences during the main sequence phase, through their effects on the approach to equilibrium of the CNO cycle energy generation rates. A star with higher CNO abundance but similar metal abundance has a main sequence turnoff point of lower luminosity and effective temperature. Dissert. Abstr.

N81-10909*# College of William and Mary, Williamsburg, Va. Dept. of Mathematics and Computer Science.
DYNAMICS OF COLLISIONLESS SYSTEMS Final Technical Report, Oct. 1978 - Aug. 1980
Thomas A. Zang Aug. 1980 11 p
(Grant NsG-1564)
(NASA-CR-163234) Avail: NTIS HC A02/MF A01 CSCL 03B

The three dimensional dynamics of rotating stellar systems were studied. A comparison of various mathematical models of flat galaxies is presented. The effects of self-gravity upon a flat galaxy undergoing a tidal encounter with another galaxy were investigated. T.M.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-10910*# National Aeronautics and Space Administration, Washington, D. C.
VOYAGE TO JUPITER
David Morrison and Jane Samz 1980 204 p Original contains color illustrations
(NASA-SP-439; LC-80-600126) Avail: NTIS MF A01; SOD HC $7.50 CSCL 03B

Early observations of the Jovian system are reviewed as well as the scientific objectives of the Pioneer and Voyager flyby missions. Launch vehicles, spacecraft trajectories, and the instruments carried are described. Photographs obtained by both voyage spacecraft are presented along with day-by-day summaries of the findings recorded by the various instruments and experiments carried by each spacecraft. Pictorial maps of the Galilean satellites, and lists of the Voyager science and managements teams are included. A.R.H.

N81-10911# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
SATELLITE SWEEPING OF ELECTRONS AND PROTONS IN SATURN'S INNER MAGNETOSPHERE Progress Report
R. Rairden Jul. 1980 37 p refs
(Contract N00014-76-C-0016)
(AD-A087896; UOI-80-29) Avail: NTIS HC A03/MF A01 CSCL 03/2

In a computer simulation, particles of various energies were followed along their orbits to determine the probability of their absorption during one encounter with an inner satellite of Saturn, giving special consideration to leapfrog and corkscrew escape factors. The time interval between encounters may then be used to yield a measure of particle lifetimes in given satellite L shells. Energy and pitch angle dependence of satellite sweeping efficiency is illustrated. As expected, the small gyroradius electrons are completely absorbed in one satellite encounter, while the large gyroradius protons exhibit varying degrees of depletion. GRA

N81-10929# Sheffield Univ. (England). Dept. of Physics.
SPACED STATION METEOR WIND STUDIES
R. Young, H. G. Muller, and S. P. Kingsley *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 77-79 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-10912# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 428, APRIL 1980. PART 1: PROMPT REPORTS Progress Report, Feb. - Mar. 1980
Apr. 1980 171 p
(PB80-197635; SGD-428-Pt-1; NOAA-80051907) Avail: NTIS HC A08/MF A01 CSCL 03B

In addition to an index for 1979 to 1980, data are provided for March 1980 on alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, coronal holes and Boulder Geomagnetic Substorm Log. It also provides data for February 1980 on daily solar activity centers, sudden ionospheric disturbances, solar radio emission, cosmic rays, geomagnetic indices and radio propagation indices. Late data included in this issue presents cosmic rays January 1980, geomagnetic indices January 1980 and daily solar activity centers for late January 1980 and December 1979. GRA

N81-10913# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 428, APRIL 1980. PART 2: COMPREHENSIVE REPORTS Progress Report, Oct. 1979
Apr. 1980 36 p refs
(PB80-197643; SGD-428-Pt-2; NOAA-80051908) Avail: NTIS HC A03/MF A01 CSCL 03B

An index for 1979 to 1980, and comprehensive reports provide data for October 1979 on: solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. Solar flare data are now over a year delayed from date of observation, rather than the usual six months. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N81-10938# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ASTRO-HEL: A SOUNDING ROCKET PROGRAM FOR HIGH-RESOLUTION ANALYSIS OF HELIUM EUV RADIATIONS
R. Weber and R. Henkel *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 155-160 (For primary

document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

99 GENERAL

N81-10914# European Space Agency, Paris (France).
EUROPEAN ROCKET AND BALLOON PROGRAMS AND RELATED RESEARCH
T. D. Guyenne, ed. and G. Levy, ed. Jun. 1980 555 p refs Partly in ENGLISH and FRENCH Proceedings of 5th ESA Programs and Related Res., Bournemouth, Engl., 14-18 Apr. 1980 Original contains color illustrations
(ESA-SP-152) Avail: NTIS HC A22/MF A01

Topics include reviews of national programs and future plans, descriptions of research in middle atmospheric physics, balloon, rocket, and payload technology, For individual titles, see N81-10915 through N81-10993.

N81-10915# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).
AURORAL PARTICLE ACCELERATION: AN EXAMPLE OF A UNIVERSAL PLASMA PROCESS **c46**
G. Haerendel *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 9 p refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The occurrence of discrete and narrow auroral arcs is attributed to a sudden release of magnetic tensions set up in a magnetospheric-ionospheric current circuit of high strength. At altitudes of several 1000 km the condition of frozen in magnetic fields can be broken temporarily in thin regions corresponding to the observed width of auroral arcs. This implies magnetic field-aligned potential drops of several kilovolts supported by certain anomalous transport processes which can only be maintained in a quasi-stationary fashion if the current density exceeds a critical limit. The region of field aligned potential drops is structured by two pairs of standing waves which are generalized Alfven waves of large amplitude across which the parallel electric field has a finite jump. The waves are emitted from the leading edge of the acceleration region which propagates slowly into the stressed magnetic field. Author (ESA)

N81-10916# Centre National de la Recherche Scientifique, Paris (France).
THE FRENCH SOUNDING ROCKET AND BALLOON PROGRAMS [LE PROGRAMME FRANCAIS DE RECHERCHE SPATIALE EN FUSEES-SONDES ET EN BALLONS] **c46**
J. P. Chassaing *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 3-6 In FRENCH (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A summary of activities is presented. The sounding rocket programs include several which involve international cooperation in astronomy, fields and particles, and materials science. The balloon programs include activities in the fields of astronomy, solar physics, aeronomy and space biology. The development program for stratospheric balloons is described. Author (ESA)

N81-10917# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projekttraegerschaften.
THE GERMAN SCIENTIFIC BALLOON AND SOUNDING ROCKET PROGRAM **c46**
A. F. Dahl and M. Otterbein (Bunderministerium fuer Forschung und Technologie, Bonn) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 7-17 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Rocket sounding programs in the fields of astronomy, aeronomy, magnetospheric research, and materials science under microgravity are described. The scientific balloon programs, with emphasis on astronomical research are summarized. Tables showing the main program characteristics of the projects to 1983 are presented. Author (ESA)

N81-10918# Oslo Univ. (Norway). Inst. of Physics.
THE NORWEGIAN SOUNDING ROCKET PROGRAM, 1980 TO 1983 **c46**
A. Egeland and A. Gunderson (Royal Norwegian Council for Science and Industrial Research, Oslo) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 19-24 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Exploration of the polar ionosphere plays a central part in the Norwegian research program in science. An important facility in the Norwegian space program is the Andoeya Rocket Range. Advanced radio installations in northern Scandinavia together with the new optical site at Svalbard are shown to be valuable for in situ measurements and theoretical work on the polar ionosphere. Author (ESA)

N81-10919# Uppsala Ionospheric Observatory (Sweden).
THE SWEDISH SOUNDING ROCKET PROGRAM **c46**
R. Bostroem *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 25-28 Sponsored by Swedish Board for Space Activities (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Within the Swedish Sounding Rocket Program experimental studies in magnetospheric and ionospheric physics, upper atmosphere physics, astrophysics, and material sciences in zero gravity are performed. Projects are planned for studies of auroral electrodynamics using high altitude rockets, investigations of noctilucent clouds, and active release experiments. Coordination with EISCAT and the planned Viking satellite are mentioned for future projects. Author (ESA)

N81-10920# Science Research Council, Slough (England).
THE UNITED KINGDOM ROCKET AND BALLOON PROGRAM **c46**
J. T. Delury *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 29-31 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The United Kingdom civilian scientific balloon and rocket program for 1979, 1980, 1981 are summarized and the areas of scientific interest for the period 1981 to 1985 are mentioned. Ten balloons up to 40 cu m to be launched from the USA or Australia and launches of up to ten 7.5 in. diameter Petrel rockets are planned. Author (ESA)

N81-10921# Freie Univ., Berlin (West Germany).
TEMPERATURE CHANGES IN THE MESOSPHERE AND STRATOSPHERE CONNECTED WITH CIRCULATION CHANGES IN WINTER **c46**
K. Labitzke *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 35-43 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The midwinter temperature changes in the mesosphere and stratosphere are described, and it is shown that the stratospheric midwinter warmings extend into the upper mesosphere. The large interannual variability of the polar stratospheric temperatures during winter is discussed. Author (ESA)

N81-10922# Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie.
RECENT TEMPERATURE AND WAVE PROPAGATION RESULTS BETWEEN 30 AND 100 KM OBTAINED BY LIDAR TECHNIQUES **c34**
M. L. Chanin, A. Hauchecorne, and P. Juramy *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 45-48 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Lidar sounding obtained from two stations using two different scattering process have led to results on photochemisty, structure and dynamics in the altitude range from 30 to 100 km. Information about temperature and wave propagation which can be obtained from this type of measurement is emphasized. It is concluded that if both scattering processes are used, a

continuous survey of temperature and motion can be provided.
Author (ESA)

N81-10923# Science Research Council, Slough (England).
MESOSPHERIC TEMPERATURES DEDUCED FROM LASER OBSERVATIONS OF THE NaD2 LINE PROFILE **c46**
L. Thomas and S. K. Bhattacharyya *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 49-50 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A description is given of an experiment to measure mesospheric temperatures using laser observations of resonance scatter from sodium atoms. A tunable narrow band laser is used to measure the profile of the sodium D2 line and temperatures are deduced from the theoretical curves providing the best fit to the data. Author (ESA)

N81-10924# Science Research Council, Slough (England).
MIDDLE ATMOSPHERE TRACE CONSTITUENTS AS MEASURED BY NIMBUS-7 **c46**
J. T. Houghton *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 51-54 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Observations of infrared radiation from the atmosphere's limb enable the distribution of minor constituents to be determined. The Limb Infrared Monitor of the Stratosphere (LIMS), the Stratospheric and Mesospheric Sounder (SAMS) instruments on Nimbus 7 contained channels for the measurement of temperature, H2O, O3, NO2, N2O, CH4, CO, and NO and HNO3. Some details of the problem of attitude determination are addressed and some preliminary results for atmospheric temperature, H2O, and HNO3 from SAMS and LIMS presented. Author (ESA)

N81-10925*# Liege Univ. (Belgium). Inst. d'Astrophysique.
A TWO-DIMENSIONAL MODEL OF ODD NITROGEN IN THE THERMOSPHERE AND MESOSPHERE **c46**
J. C. Gerard, R. G. Roble (National Center for Atmospheric Research), and D. W. Rusch (Colorado Univ.) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 55-60 refs Sponsored in cooperation with Belgian Foundation for Scientific Research (For primary document see N81-10914 01-99)
(Grant LSG-5372)
Avail: NTIS HC A22/MF A01 CSCL 04A

Satellite measurements of the global nitric oxide distribution demonstrating the need for a two dimensional model of odd nitrogen photochemistry and transport in the thermosphere and mesosphere are reviewed. The main characteristics of a new code solving the transport equation for N(4S), N(2D), and NO are given. This model extends from pole to pole between 75 and 275 km and reacts to the magnetic activity, the ultraviolet solar flux, and the neutral wind field. The effects of ionization and subsequent odd nitrogen production by high latitude particle precipitation are also included. Preliminary results are illustrated for a magnetically quiet solar minimum period with no neutral wind. Author (ESA)

N81-10926# Norwegian Defence Research Establishment, Kjeller.
OBSERVATIONS OF FINE SCALE STRUCTURE IN THE MESOSPHERE AND LOWER THERMOSPHERE **c46**
E. V. Thrane and B. Grandal *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 61-65 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

An electrostatic probe designed to measure ion density with high time resolution and accuracy was flown on a Nike-Apache rocket from Andoeya Rocket Range on March 1 1978. Spectra of the spatial density fluctuations were derived in one kilometer height intervals from 65 to 127 km. Below 95 km the power spectra had a slope of about -5/3, as expected for isotropic turbulence. Above 95 km the fluctuations were stronger and showed a white noise power spectrum. These fluctuations are most likely due to plasma instabilities. Author (ESA)

N81-10927# Sheffield Univ. (England). Dept. of Physics.
THE SEMI-DIURNAL TIDE IN THE LOWER THERMOSPHERE **c46**
T. R. Kaiser, S. P. Kingsley, H. G. Muller, and P. Rutter *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 67-70 refs Sponsored by UK Science Research Council (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Detailed studies of the semi-diurnal tide were made using two lengthy series of data from a meteor wind radar. Fourier transforms of the wind amplitude time series were computed and the inverse transforms then calculated, using windows of appropriate bandwith, centered on the component with a period of 12 hours. As well as giving information on the amplitude variation of the tide throughout the recording periods, it was possible to make a detailed study of the tide's phase variations on the two observing aerials. Author (ESA)

N81-10928# Sheffield Univ. (England). Dept. of Physics.
QUASI TWO-DAY OSCILLATIONS IN THE LOWER THERMOSPHERE **c46**
H. G. Muller and S. P. Kingsley *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 71-75 refs Sponsored by UK Science Research Council and Meteorological Office (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Significant quasi two day oscillations in the wind at meteor heights have now been firmly established as the effects of zonally traveling planetary-scale waves. The waves are found to be traveling predominantly westward with wave number three. It is suggested that the oscillations represent an atmospheric free mode which exhibits considerable amplification after the summer solstice. Author (ESA)

N81-10929# Sheffield Univ. (England). Dept. of Physics.
SPACED STATION METEOR WIND STUDIES **c91**
R. Young, H. G. Muller, and S. P. Kingsley *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 77-79 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Meteor wind radar data are collected over a relatively large geographical area with a single station. When transmitters of moderate power are used the data must be integrated for periods of typically half an hour during the afternoon when the echo rate is low to produce a sounding of the wind structure in the lower thermosphere. The wind components resolved are therefore of planetary magnitude and the short period and small scale internal gravity waves, known to exist at meteor heights, frequently go unresolved. It is believed that these gravity waves could be of considerable importance to the dynamics of the upper atmosphere and could account for up to 30 K heating per day. A system is described which was developed specifically to investigate these oscillations using separate receiving stations spaced a few kilometers from the main radar site, thus receiving reflections from a number of points along each meteor train. A further advantage of this system is that it removes an error on the single aerial system caused by reflections obtained in the back lobes. Author (ESA)

N81-10930# University Coll., London (England). Dept. of Physics and Astronomy.
ASYMMETRIC GLOBAL CIRCULATION SYSTEMS FOLLOWING GEOMAGNETIC SUBSTORMS **c47**
D. Rees, T. J. Fuller-Rowel, and P. A. Rounce *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 81-88 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A three dimensional, time dependent, global model of the thermosphere was developed to study both steady state and time varying phenomena. When the response of the thermosphere to steady and time varying high latitude sources of momentum and energy is simulated in the real condition of noncoincident geographic and geomagnetic poles a number of differences arise. Results from the steady state simulation implies that a much smaller demand is made on particle heat sources, due to an increase in the Joule heating effects. The response of the thermosphere to a geomagnetic substorm is shown to develop a number of phenomena which are strongly dependent on both longitude, local time, and the UT occurrence of the substorm. In particular, the amplitudes of the propagating gravity waves

are strongly asymmetry of the high latitude energy and momentum sources associated with the substorm. Author (ESA)

N81-10931# University Coll., London (England). Dept. of Physics and Astronomy.
MIDDLE ATMOSPHERE WINDS FROM A BALLOON-BORNE FABRY-PEROT INTERFEROMETER c47
D. Rees, P. A. Rounce, and I. McWhirter *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 89-101 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

As part of a development program aimed at deploying a high Resolution Doppler Imager (HRDI) on NASA Shuttle missions in 1984, a prototype instrument is being flown from a balloon-borne platform in early 1980 to test and demonstrate the experimental technique. The balloon borne Fabry-Perot interferometer measures winds from about 5 km to 35 km by observing the Doppler shift of absorption lines in the solar spectrum due to atmospheric species such as O2 and H2O, and observes the thermospheric and mesospheric emissions of atomic oxygen (630.0 nm and 557.7 nm). A summary of the performance of the instrument, using data obtained from preflight tests, is given with a brief discussion of the optimization necessary for the Shuttle borne flights of the HRDI. Author (ESA)

N81-10932*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for Extraterrestrial Physics.
MIDDLE ATMOSPHERE ELECTRIC FIELDS c46
N. C. Maynard *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 105-114 refs Sponsored in part by Royal Norwegian Council for Science and Industrial Research (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A review is presented describing the classical picture relative to sources of electric fields in the middle atmosphere, the coupling of these sources and factors which cause variations in the coupling functions. Measurement techniques for middle atmosphere electric fields and results of measurement attempts are also given. Author (ESA)

N81-10933# Bern Univ. (Switzerland). Physikalisches Inst.
POSITIVE ION COMPOSITION IN NOCTILUCENT CLOUDS c46
E. Kopp, P. Eberhardt, U. Herrmann, and L. Bjoern (Uppsala Ionospheric Observatory, Sweden) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 117-118 refs Submitted for publication (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

As part of the 1978 European Summer Campaign for a study of the noctilucent clouds (NLC) the positive ion composition and the electron density were measured in the D region above Esrange on July 30 and on August 13. Faint noctilucent clouds were observed from an aircraft previous to the launch sequences. The altitude of the NLC on July 30 was 82.5 to 83.5 km determined from an in situ measurement of the backscatter light on the downleg of the rocket flight S32. Positive ions were measured with a magnetic sector field spectrometer in the mass range 14 to 230 amu. On July 30, the composition of the positive ions in the D region exhibited an unusual variation of protohydrated ions. Around the mesopause between 77 and 90 km protonhydrates are the dominant positive ions exceeding the molecular ions NO + and O2 + by more than a factor of 50. Author (ESA)

N81-10934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECENT SOUNDING ROCKET HIGHLIGHTS AND A CONCEPT FOR MELDING SOUNDING ROCKET AND SPACE SHUTTLE ACTIVITIES c12
J. H. Lane and E. E. Mayo *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 121-132 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Highlights include launching guided vehicles into the African Solar Eclipse, initiation of development of a Three-Stage Black Brant to explore the dayside polar cusp, large payload Aries Flights at White Sands Missile Range, and an active program with the Orion vehicle family using surplus motors. Sounding rocket philosophy and experience is being applied to the shuttle in a Get Away Special and Experiments of Opportunity Payloads Programs. In addition, an orbit selection and targeting software system to support shuttle pallet mounted experiments is under development. Author (ESA)

N81-10935# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Systemtechnik.
THE EVOLUTION OF PAYLOAD SYSTEMS c12
J. J. Turner *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 133-139 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The applications of technological innovation to sounding rockets and balloon systems are described. The survey includes developments in solid state electronics, computer and sensor technology, telemetry and telecommand, techniques for gyroscopic sensors, optical sensors using CCD arrays, low light television, the use of PCM, and the use of S band data transmission. Author (ESA)

N81-10936# Air Force Geophysics Lab., Hanscom AFB, Mass.
POST-BURNOUT THRUST MEASUREMENTS c15
E. F. McKenna and H. T. Smith (Space Vector Corp., Northridge, Calif.) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 141-145 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Research was conducted into the problems of avoiding collision between separated payloads and spent rocket motors due to post burnout thrust, and the problem of contamination of scientific instrumentation due to outgassing of the smoldering insulation. The post burnout thrust was measured using a payload instrument module separated from an instrumented Black Brant VC Rocket in the exoatmosphere. In addition to measuring acceleration and velocities the spent motor was observed by a TV camera on board the command attitude controlled payload module. Analysis shows that the payload separated cleanly from the vehicle at a relative separation velocity of 0.69 m/sec, however the residual thrust of the spent motor overcame this differential, catching up to the payload 37 sec after separation and continuing on a parallel velocity vector at about 1.03 m/sec. Author (ESA)

N81-10937# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ASTRO 4: A SOUNDING ROCKET PROGRESS OF THE X-RAY ASTRONOMY c89
R. Henkel and H. Pechstein *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 147-153 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A technical description of Astro 4 payload is given. The Astro 4/1 project performs X-ray spectroscopic investigations and imaging of solar coronal active regions by means of zone plate cameras, a Rowland spectrograph and a KAP crystal spectrometer as part of a three axis stabilized payload. The Astro 4/2 project investigated the X ray sources Puppis A and the Crab Nebula by means of a Wolter Telescope, equipped with a position sensitive proportional counter. Author (ESA)

N81-10938# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ASTRO-HEL: A SOUNDING ROCKET PROGRAM FOR HIGH-RESOLUTION ANALYSIS OF HELIUM EUV RADIATIONS c93
R. Weber and R. Henkel *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 155-160 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A technical description of a three axes stabilized payload developed for the three stage rocket Skylark 12 and designed for an apogee of more than 800 km is given. The scientific payload is a helium resonance cell EUV photometer instrumented for high resolution spectral analysis of He I 58.4 nm and He II 30.4 nm radiation. The experiment which consists mainly of

four measuring cells, supply systems, and baffle system, is accommodated in the top payload section and covered by a split nose cone during ascent. Author (ESA)

N81-10939# Saab-Scania, Linkoping (Sweden).
THE 533 PROJECT: ITS MISSION AND PAYLOAD c12
L. Ljunge *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 161-165 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A Nike-BBVC rocket equipped with an S19 guidance system will be launched at Esrange in October 1980. The payload contains two scientific experiments: an IR telescope (the PIRAT) for studying interstellar dust grains in the far infrared band and a zero-gravity module (the MURMEC) for metal solidification studies. The experiments are described, as well as the payload subsystems and the low-acceleration environment simulation in a scanning payload. Author (ESA)

N81-10940# British Aerospace Dynamics Group, Bristol (England).
MODEST PAYLOADS FOR SHUTTLE c16
D. J. Brown and L. Callard *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 167-176 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Shuttle payloads that are larger than the low cost 'Getaway Specials' but smaller than major cargo elements are designated as 'modest' category, and include both free-flying and attached payloads which need to be autonomous with regard to Orbiter services. A three-axis stablized platform is described, which meets 'modest payload' requirements and is a modular concept suitable for a wide variety of experiments. This facility includes subsystems such as power, data storage, and attitude control. Emphasis was placed on maximum use of sounding rocket technology and approach in order to minimize development costs. Performance data is provided on pointing accuracy, power supplies, mission duration, etc., in order to enable experimenters to select suitable experiments. Author (ESA)

N81-10941# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
SOME REMARKS ON POST-FLIGHT ANALYSIS OF SOUNDING ROCKETS c61
G. Schneiders, H. J. Kramer, A. Craubner, and W. Zeigltrum *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 177-181 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Program packages for postflight analysis of sounding rockets are described. These packages were tested and enhanced using data obtained from the projects IMS-T, ARIES-PORCUPINE and *TEXUS 1, 2. The programs include the creation of ORBIT/* ATTITUDE-Files, the creation of EXPERIMENT-DATA-Records, and the fitting of experiment and housekeeping data with *several techniques.* Author (ESA)

N81-10942# Deutsche *Forschungs- und Versuchsanstalt fuer* Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Systemtechnik.
A SMALL, EFFICIENT SUN POINTING BALLOON GONDOLA c35
J. How *In* ESA European Rocket and Balloon Programs and *Related Res. Jun. 1980 p 183-187* (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A balloon gondola was designed and built to provide a sun pointing capability. The gondola carried small radiometer instruments to measure trace gases in the Earth's *atmosphere by absorption techniques as part of the ground truth measurement* program in conjunction with the Limb Infrared Monitor of the Stratosphere *experiment on the NIMBUS 7 satellite. The gondola provided two axis* stabilization to better than 3 arc mins by means of a twin axis sun sensor controlling an experiment *mounting plate in elevation and the complete gondola in azimuth.* The design of the gondola and the performance obtained during flights from Oberpfaffenhofen, W. Germany and Palestine, Texas *are discussed.* Author (ESA)

N81-10943# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany).
THE ARIES HEAT SINK c15
G. Haerendel, J. J. Jerger, and J. H. Jerger *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 189-197 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The failure analysis performed for ARIES sounding rocket motor failures, and the remedy developed for motor overheating are described. The principal failure hypothesis was that the motor-dome insulator fails under high gravity boost and the subsequent radiant heating of the titanium motor dome weakens the pressure vessel. The supporting heat transfer and ablation analyses are summarized. These detailed analyses and digital simulations quantitatively correlated the precise time-of-failure with known ablation and heat transfer rates and established firm design criteria for the aluminum heat sink. Analysis of the international magnetospheric study test rocket temperature data is described. This analysis confirmed the validity of the design and the effectiveness of the heat sink. Author (ESA)

N81-10944# Air Force Geophysics Lab., Hanscom AFB, Mass.
SPECIAL CONSIDERATIONS TO ASSURE FLIGHT SUCCESS WITH LARGE, EXPENSIVE ROCKET PAYLOADS c12
C. D. Howard and R. O. Rasmussen (Space Vector Corp., Northridge, Calif.) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 199-201 ref (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The typical sounding rocket philosophy of high risk, low cost, and rapid response is being modified by the advent of more expensive, complex, and larger ARIES payloads now being used to support high priority Department of Defense programs. Payload problem areas are identified and some solutions to increase probability of flight success are identified. Increased costs and more time on planning, engineering, and testing are indicated. Author (ESA)

N81-10945# Deutsche Forschungs- und Versuchsanstalt fuer *Luft- und Raumfahrt, Oberpfaffenhofen* (West Germany). Mobile Raketenbasis.
DEVELOPMENT AND NEW TASKS OF THE DFVLR-GSOC MOBILE RAKETENBASIS c19
R. Klein *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 205-210 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A short review of several *sounding rocket and balloon* campaigns is given with emphasis on the operational aspects. Also described are activities of the group, outside the field of *sounding rockets and balloons. Programs were conducted in* Sweden, Australia, Brazil, Germany, Spain, and the Antarctic. Author (ESA)

N81-10946# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
EL ARENOSILLO SOUNDING ROCKET RANGE c19
J. Casas and M. Vilches *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 211-216 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A description is presented of the El Arenosillo Sounding Rocket Range and facilities, which include an automatic tracking telemetry system in S band (2200-2300 Mhz) and also autotrack *meteorological band (1600-1700 Mhz), semiautomatic mode* (200-300 and 400-500 Mhz) and manual mode 115-150 Mhz. A brief summary of launchings and activities are given. Author (ESA)

N81-10947# *Centre National de la Recherche Scientifique,* Toulouse (France).
BALLOON LAUNCHING FACILITIES IN FRANCE [LES *CENTRES DE LANCEMENT DE BALLOONS EN FRANCE]* c12
M. Audebert and C. Bannelier *In* ESA European Rocket and *Balloon Programs and Related Res. Jun. 1980 p 217-218* In FRENCH (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

Balloon launching facilities are described with emphasis on new equipment such as PCM telemetry at 16 K bits, the extension to 200 commands of the telecommand system, and the possibility of high altitude special purpose balloons with electronically driven controls to optimize flight duration, specially during the monsoon inversion period. Author (ESA)

N81-10948# Centre National de la Recherche Scientifique, Toulouse (France).

TRANSMEDITERRANEAN FLIGHTS c02

A. Soubrier, M. Malavasi (CNR), and J. Pueyo (Comision Nacl. de Invest. del Espacio) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 219-221 (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

The transmediterranean balloon flights performed from Sicily to Spain within an international cooperation program are briefly described. A total of eight flights were performed, with a flight duration of between 18 and 27 hours. The balloon launching facilities, the telemetry system and the telecommand system are presented. Flights take place during the high altitude easterlies (June, July, August). Author (ESA)

N81-10949# Swedish Space Corp., Kiruna.

ESRANGE ACTIVITIES: SOUNDING ROCKETS, BALLOONS AND SATELLITES c19

A. Helger *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 223-229 (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

The range facilities are described in detail for the prospective user, including instrumentation launch capabilities, support facilities, and costs. High performance sounding rockets such as Aries and Nike BB can now, thanks to guidance systems, be launched above 500 km allowing the exploration of higher regions and longer observation time. Microgravity experiments using sounding rockets are successfully carried out from the range. Land recovery is necessary in this case. Since 1978 Esrange has been operating a Landsat remote sensing satellite receiving station as part of ESA's ground station network, Earthnet. Additional installations for reception and processing of SPOT and Landsat (D) data are planned. A satellite tracking and control station is envisaged in the near future. Author (ESA)

N81-10950# Royal Norwegian Council for Scientific and Industrial Research, Oslo. Space Activity Div.

RECENT AND FUTURE INVESTMENTS AT THE ANDOEYA ROCKET RANGE c19

A. Adolfsen, R. Bjurstroem, and A. Gundersen *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 231-234 (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

The Andoeya facilities are described with emphasis on recent equipment acquisitions and potential development. The description includes the instrumentation at the optical site, the S band telemetry and the NORD 10/S computer. Author (ESA)

N81-10951# Bergen Univ. (Norway). Dept. of Physics.

SBARMO-79: EXPERIMENTS AND RESULTS c46

S. Ullaland, J. Bjordal, L. P. Block (Royal Inst. of Technol., Stockholm), K. Broestad (Oslo Univ., Norway), A. Egeland (Oslo Univ., Norway), J. Holtet, J. Kangas (Oulu Univ., Finland), G. Kremser (Max-Planck Inst. fuer Aeronomie), M. M. Madsen (Danish Space Research Inst., Lyngby), T. Moe et al *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 235-240 Original contains color illustrations Sponsored by Austrian Scientific Research Council, Finnish National. Research Council of Science, NTNF, Swedish Board for Space Activities, Austrian Academy of Science, and Deutsche Forschungsgemeinschaft (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

The joint European International Magnetospheric Study (IMS) balloon project is reviewed. A total of 39 balloons, 29 successfully, were launched from four launch sites in northern Scandinavia. Downwind telemetry stations were in operation in Norway, Iceland, and Greenland. Operational experiences and examples of data summaries are presented. The project goals include an increased understanding of dynamic processes in the magnetosphere such as coupling phenomena between outer magnetosphere and auroral regions and magnetospheric convection patterns. Payload configurations are given, and an example is presented of data taken during X-ray events on July 6, 1979. Author (ESA)

N81-10952# Mullard Space Science Lab., Dorking (England). Dept. of Physics and Astronomy.

WAVE-PARTICLE INTERACTIONS IN THE HIGH ALTITUDE AURORAL IONOSPHERE c46

A. D. Johnstone *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 243-255 refs (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

Current knowledge of the non-linear effects associated with beam-plasma interactions is reviewed to determine how the electron velocity distributions would be modified. Many of the observed differences follow quite naturally from the general effects to be expected. There is no reason yet to reject the idea that auroral electrons are accelerated by a parallel electric field although more work is needed on detailed comparisons to confirm these conclusions. Author (ESA)

N81-10953# Kiruna Geophysical Inst. (Sweden).

ELECTRON SPECTRA OVER DISCRETE AURORAS AS MEASURED BY THE SUBSTORM-GEOS ROCKETS c46

I. Sandahl, L. Eliasson, and R. Lundin *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 257-262 refs (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

Results from the first two Substorm GEOS rockets are presented. These rockets, as well as the third one, were launched from ESRANGE on January 27, 1979 into different substorm phases. The first rocket went into an active pre-breakup evening arc and the second one into a breakup close to magnetic midnight. Electron spectra of downcoming particles measured by a narrow energy bandwidth detector show very narrow energy peaks as soon as the integral energy fluxes are high. These peaks always show populations of two different characteristic energies above the peak energy. One of the populations has properties similar to those found in the boundary layer plasma and the other one seems to be of plasma sheet origin. The plasma sheet-like population is also seen where there are no signs of energy peaks, for example equatorward of the arc. The boundary layer plasma is exclusively connected with the signatures of acceleration. Author (ESA)

N81-10954# Kiruna Geophysical Inst. (Sweden).

SOME RESULTS FROM THE AURORAL PARTICLE EXPERIMENT ON BOARD THE BARIUM-GEOS ROCKET c46

L. Eliasson, R. Lundin, and I. Sandahl *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 263-268 refs (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

The Barium GEOS rocket was launched from Esrange on September 24, 1979 during the expansion phase of a magnetic substorm. Electron and positive ion measurements were performed with detectors looking in different directions relative the rocket spin axis with high angular resolution in the energy range 70 eV - 21 KeV. Peaked electron energy spectra were observed during most of the flight. Highly collimated electron fluxes (within 10 degrees) were often seen at the energy level just below the peak energy. Most of the observed features of the electron distribution are found to be consistent with an acceleration mechanism including a parallel potential difference. The mechanism including a parallel potential difference. The characteristic energy is found to increase and the number density to decrease as the accelerating voltage increases. This is in good agreement with a theory predicting that the potential drop is built up as a consequence of a magnetospheric dynamo requiring a current of a certain magnitude to flow along the magnetic field lines. Author (ESA)

N81-10955# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).

STUDY OF MAGNETOSPHERIC SUBSTORM EVENTS c46

K. Wilhelm *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 269-277 refs (For primary

document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

High altitude sounding rocket payloads, (four), of the project 'Substorm phenomena' were launched from the Andoeya Rocket Range during the period 13 October 1977 to 30 January 1978. The scientific goal was a detailed investigation of magnetospheric-substorm related particle and field effects in the auroral zone. Coordination with British and US rocket programs led to salvoes of up to three payloads launched into single auroral events providing the opportunity of time history studies during the course of magnetospheric substorms. A number of ground-based observations were performed and data summaries are presented. Author (ESA)

N81-10956# *Max-Planck-Institut fuer Aeronomie, Katlenburg-*Lindau (West Germany).

SOUNDING ROCKET OBSERVATIONS OF FIELD-ALIGNED CURRENT SHEETS **c46**

K. Wilhelm, N. Kloecker (Technische Univ., Brunswick), B. Theile (Technische Univ., Brunswick), W. Ott (Fraunhofer Inst. fuer Physikalische Messetechnik, Freiburg), K. Spenner (Fraunhofer Inst. fuer Physikalische Messetechnik, Freiburg), R. Grabowski (Fraunhofer Inst. fuer Physikalische Messetechnik, Freiburg), H. Wolf (Fraunhofer Inst. fuer Physikalische Messetechnik, Freiburg), W. Stuedemann, G. Dehmel (Tech. Univ., Brunswick), H. M. Fischer (Kiel Univ.) et al *In* ESA European Rocket and Balloon Programs and Related Res. (date Jun. 1980 p 279-284 refs Sponsored by Bundesministerium fuer Forschung und Technologie and Austrian Akademie der Wissenschaften (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A high-altitude sounding rocket payload launched into an auroral break-up event encountered at least two well developed current sheets at the northern boundary of the auroral activity region. In the upward directed current regime, the charge carriers were predominantly precipitating energetic electrons embedded in a low-density, high-temperature magnetospheric plasma. The downward directed currents, on the other hand, were accompanied by a high-density, low-temperature plasma. Signatures of the current sheets could be identified in the perpendicular electric field as shock-like intensity and direction variations as well as in spectral modifications of high-energy electron and proton fluxes. Author (ESA)

N81-10957# Science Research Council, Slough (England). Rutherford and Appleton Lab.

THE INFLUENCE OF ENERGY DIFFUSION ON AURORAL PARTICLE DISTRIBUTION **c46**

D. S. Hall *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 285-288 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Observations of electrons precipitating from the magnetosphere to the ionosphere under a variety of auroral conditions suggest that the velocity distributions are formed by energy diffusion. Two possibilities are considered to account for the diffusion. It results either following electron acceleration through a potential difference, or as a consequence of plasma turbulence that accelerates electrons stochastically. It is found that the latter more readily accounts for the observations. Author (ESA)

N81-10958# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).

OBSERVATION OF AN ENERGETIC PROTON BEAM AND THE GENERATION OF ULF-WAVES ABOVE ACTIVE AURORAL FORMS **c46**

W. Stuedemann and C. K. Goertz *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 289-291 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Measurements of nearly monoenergetic 65 KeV protons above active auroral forms were obtained on a rocket flight from Andenes (Norway) on Oct. 13, 1977. Analysis of the pitch angle distribution of the 30 KeV protons and the azimuthal anisotropy of the proton fluxes support a model of a proton beam of finite spatial extent. The particle observations occur simultaneously with ULF-waves in the frequency range 0.5 - 5Hz. The particle distribution function is unstable to an amplification of obliquely propagating Alfven waves. It is concluded that the waves amplified by resonant interaction with the proton beam. Author (ESA)

N81-10959# *Southampton Univ. (England). Dept. of Physics.*

TELEVISION OBSERVATIONS OF THE BARIUM-GEOS ION JET EXPERIMENT **c46**

M. A. Hapgood, H. L. Collin, and P. Rothwell *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 293-296 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The barium jet released by the Barium-GEOS rocket was observed by low light television cameras at Skibotn, Norway, and Esrange, Sweden. The release produced a single well-defined jet containing barium ions with initial velocities between 7 and 12 km/s systematically slower than the velocities reported in previous experiments. Accurate data were obtained on the motion of the jet for the first two minutes after release (up to a height of 2000 km). The orientation of the jet was close to that of an IGRF 1975 model field line but was significantly different from that predicted by the Barraclough and Olson field model. The motion of the jet across the field lines was southwards with a velocity of about 150 m/s. Author (ESA)

N81-10960# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.

SIMULTANEOUS OBSERVATIONS OF E AND B-ULF WAVES ABOARD A SOUNDING ROCKET PAYLOAD **c32**

N. Kloecker, H. Luehr, and R. Grabowski (Fraunhofer Inst. fuer Physikalische Weltraum-Forschung, Freiburg) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 297-299 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Magnetic and electric field variations in the frequency range of 0.5 to 4 Hz were made on a payload flown within the International Magnetospheric Study sounding rocket campaign 'Substorm phenomena'. The payload was launched into an auroral break-up. The waves show

N81-10961# Southampton Univ. (England). Dept. of Physics.

ELF/VLF WAVEFIELD MEASUREMENTS MADE AT THE TIME OF LAUNCH OF SKYLARK SL1424 **c32**

P. Cannon, W. Gibbons (Sheffield Univ., England), B. K. Madahar (Sheffield Univ., England), and L. J. C. Woolliscroft (Sheffield Univ., England) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 301-307 refs Sponsored by UK Science Research Council (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A Skylark was launched November 10 on 1978 from the Andoeya rocket range in northern Norway, when an ELF/VLF chorus event was observed by the GEOS 2 satellite and with a network of ground-based receivers. The satellite was above the equator, the rocket in the ionosphere, and the ground-based receivers were all approximately in magnetic conjugacy. Frequency against time spectrograms are presented of the wavefield obtained using all these receivers during rocket flight. Accurate timing permits a comparative study of individual chorus elements.
Author (ESA)

N81-10962# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).

MEASUREMENT OF HIGH-FREQUENCY WAVES IN AN AURORAL PLASMA **c32**

R. Pottelette and J. M. Illiano *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 309-312 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

During the campaign devoted to the study of the auroral plasma, both active and passive wave measurements were performed aboard two sounding rockets as they passed through auroral forms. In the active experiment, the waves were excited by means of a radio-frequency probe of the quadripolar type. Very fine interference structure in the received signal was observed; particularly in the presence of precipitating electrons. Electrostatic waves are excited below the third harmonic of the electron gyrofrequency (FB). In the passive experiment, the cross-spectrum of natural random electrostatic waves received on two antennas were measured. Natural emissions around f

sub b/2, 3f sub b/2 and around the upper hybrid frequency (fUH) were observed. The amplitudes of these emissions are above the thermal level of the plasma, but they correspond to a very low turbulence level. Author (ESA)

N81-10963# Southampton Univ. (England). Dept. of Physics.
MAPPING OF AURORAL FORMS FROM AN ALL-SKY COORDINATE GRID **c46**
B. S. Lanchester *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 313-315 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A computer program was written to produce plots of latitude and longitude values as seen by an all-sky TV camera for different heights above the Earth. The transformations in these calculations were used to construct models of the variation of apparent width of arcs of different heights and thicknesses in different positions across the sky, assuming the model arcs to be East-West aligned. Measurements were then made from the TV screen of the variation of apparent width of real arcs which moved along the magnetic N-S meridian, and the results compared with the theory. The usefulness of the all-sky data became very clear, for by measuring the way that the apparent width changes with position, conclusions can be made about the height and thickness of arcs. Author (ESA)

N81-10964# Science Research Council, Slough (England). Appleton Lab.
THE 2.2 Hz OSCILLATIONS IN AURORAL ELECTRONS **c46**
D. R. Lepine, D. S. Hall, D. A. Bryant, A. D. Johnstone (Mullard Space Science Lab.), P. J. Christiansen (Sussex Univ., England), and M. P. Gough *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 317-321 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A Petrel rocket was launched from Kiruna on 25 January 1979 to compare electron intensities measured at auroral altitudes with related parameters measured at geostationary altitude by the satellite GEOS 2. A sequence of quasi-periodic oscillations in electron intensities were investigated, which appear to originate in the equatorial region, probably in the neighborhood of GEOS 2 was investigated. A similar frequency oscillation in the intensity of 500-Hz VLF emissions was observed at about the same time by the S300 wave experiment located on the satellite. Author (ESA)

N81-10965# Oslo Univ. (Norway).
DAYSIDE CUSP AURORA: CHARACTERISTICS AND PROBLEMS **c46**
A. Egeland, K. Henriksen (Tromsoe Univ., Norway), P. E. Sandholt (Tromsoe Univ., Norway), C. S S. Deehr (Alaska Univ., Fairbanks), and G. G. Sivjee (Alaska Univ., Fairbanks) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 323-330 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The characteristics of the emissions of the dayside cusp aurora were studied. The occurence and duration of discrete auroral forms superimposed on the permanent 630 nm belt (transient, rayed arcs and bands) were carefully mapped and investigated. Special attention is given to the dynamics of the dayside cusp aurora. The conclusion is that a dayside current system exists and that it is associated with the position of the cusp aurora. The intensity and movements of this current system are correlated with the nightside electroject. It is suggested that a discontinuity similar to the Harang discontinuity exists in the dayside cusp around magnetic noon. Some unsolved auroral problems, which preferably can be studied by sounding rockets from the cusp region, are pointed out. Author (ESA)

N81-10966# Sussex Univ., Brighton (England).
BUNCHING OF 8-10 keV AURORAL ELECTRONS AT MHz FREQUENCIES IN THE VICINITY OF AN ARTIFICIAL ELECTRON BEAM **c46**
M. P. Gough, G. Martelli, P. N. Smith, B. N. Maehlum (Norwegian Defence Research Establishment, Kjeller), and G. Ventura (Florence Univ.) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 331-336 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The first direct observation is reported, from a rocket-borne 'mother-daughter' experiment, of high frequency modulations (1 MHz) of 8 - 10 KeV electrons in the vicinity of an artificially injected electron beam in the auroral ionosphere. The modulation was accompanied by electrostatic emissions at the same frequency. It is suggested that the particles interacted strongly with waves propagating in the electrostatic whistler mode (oblique electron plasma waves). The technique used to observe the megahertz electron bunching can be applied to conventional rocket-borne energetic electron detectors counting below 100,000 cps and should play an important diagnostic role, for understanding the complex wave-particle interactions occurring in the aurora. Author (ESA)

N81-10967# Commissariat a l'Energie Atomique, Grenoble (France). Lab. d'Etude de la Solidification.
POTENTIAL OF MICROGRAVITY RESEARCH WITH SOUNDING ROCKETS **c12**
J. J. Favier, Y. Malmejac, and H. U. Walter (DFVLR, Cologne) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 339-344 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The interest of sounding rocket experiments in the field of materials science is discussed. The research topics suitable for microgravity experimentation are reviewed and the capability of such a means for basic research in materials science is justified. The problems linked to this kind of study are emphasized. Author (ESA)

N81-10968# European Space Agency, Paris (France).
THE SIGNIFICANCE OF SOUNDING ROCKET PROGRAMS FOR MATERIALS SCIENCE RESEARCH UNDER LOW-GRAVITY CONDITIONS **c12**
U. Huth *In its* European Rocket and Balloon Programs and Related Res. Jun. 1980 p 345-348 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The significance of sounding rocket flights for materials science research under low-gravity conditions is discussed. The basic research objectives of materials science in space is reviewed, identifying the present situation in Europe and US. The basic advantages and constraints of sounding rockets, and ESA's point of view for future promotion of sounding rocket experiments are discussed. Author (ESA)

N81-10969# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
SKIN CASTING EXPERIMENTS IN ROCKET FLIGHTS **c26**
H. Sprenger (MAN-Neue Technologie, Munich) and K. Schweitzer *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 349-356 ref Sponsored by DFVLR (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The short duration of the ballistic flight of a sounding rocket has restricted possibilities for performing experiments on directional solidification of alloys because of the minimum required ratio of temperature gradient to growth rate in order to achieve a plane solidification front. The skin technology which was proposed as a method for quality improvement of preformed components by space processing can also serve as beneficial means for conducting basic solidification studies in short time micro-gravity experiments. The problems and restrictions of skin technology in rocket flight experiments and first results of TEXUS missions 1 and 2 are reported. The demand for using very thin skins of less than 1 micrometer thickness has created complications which must be overcome by special skin deposition techniques. Author (ESA)

N81-10970# Chalmers Univ. of Technology, Goteborg (Sweden).
DIFFUSION EXPERIMENTS ON LIQUID METALS **c26**
T. Persson, L. Lindstroem (Micro Nova Corp., Sweden), L. Stenmark (Micro Nova Corp., Sweden), and R. Joesson (Swedish Space Corp., Solna) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 357-362 refs Sponsored by Swedish Board for Space Activities (For primary document see

N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The diffusion process in liquids both in a microgravity and in a l gravity environment was studied. An electrochemical method is used to collect sufficient data during a time interval comparable to the duration of a sounding-rocket flight. A brief survey of the construction of the experimental cell, the isothermal furnaces, and the electronics is given. Author (ESA)

N81-10971# Swedish Space Corp., Solna.
AN IMPROVED POWER AND TEMPERATURE CONTROL SYSTEM FOR A ROCKET-BORNE SPACE PROCESSING MIRROR FURNACE c35
S. Grahn, A. Nobinder, M. Sjoekvist, and L. Stenmark (Micro Nova Corp., Sweden) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 363-366 ref (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Operational experience with the mirror furnaces flown in the Texus 1 and 2 rockets led to the development of an improved mirror furnace system for thermal analysis of small samples. The furnace operates in two basic modes: constant optical power and sample temperature profile mode. In the constant power mode the control system maintains the same light output from the halogen lamps in convective cooling of the filament in microgravity. In the temperature profile mode the temperature at the edge of the sample is used to control the furnace power. Author (ESA)

N81-10972# British Aerospace Dynamics Group, Bristol (England).
A EUROPEAN MICRO-GRAVITY ROCKET PROGRAM c15
D. N. Hoare, J. D. Mitchard, R. Klett (Kayser-Threde GmbH, Munich), and A. Schmalz *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 367-370 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The TEXUS (Technological Experiments Under Micro-Gravity) Program is proven to be cost effective way of providing scientists with 6 to 8 minutes of experimental time under micro-gravity conditions for Spacelab pre-program experiments. An ESA sponsored material science rocket program is proposed to provide additional opportunities for European experimenters having micro-gravity experiment proposals which are not included in any existing national program. Facilities proposed include: skylark rockets; payload integration; ESRANGE launching facilities, and data reduction of experimental results. The program would provide short preparation cycles and quick recovery missions to offset delays and increasing costs of the space shuttle program. Author (ESA)

N81-10973# Swedish Space Corp., Solna.
THE PRINCIPLES OF A SAMPLE-TRACKING SPACE PROCESSING FURNACE c35
S. Grahn *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 371-373 ref (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A sample-tracking systems for containerless processing in space in which the processing chamber tracks the samples is discussed in terms of application to sounding rockets or other small f vehicles. If passive position sensing methods are used no control forces need to be applied to the sample. Thus, the propulsive forces applied to the space vehicle compensate for the drag-induced accelerations. For this reason, but also because all angular rates are referred to the center of mass of the sample and not the space vehicle, very low acceleration levels may be attained. Author (ESA)

N81-10974# Swedish Space Corp., Solna.
MURMEC: MULTIPURPOSE ROCKET-BORNE MATERIAL-SCIENCE EXPERIMENT CARRIER c35
R. Joensson, E. Soederdahl, and S. Wallin *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 375-380 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The MURMEC module was developed to be a reusable unit for different rocket-borne material science experiments. The module is divided into four sections: experiment section, experiment electronics section, interconnection and power board section, and battery case with housekeeping electronics. A short description of the experiments, planned to be performed in the first MURMEC flight is also given. Author (ESA)

N81-10975# Sussex Univ., Brighton (England).
ACTIVE EXPERIMENTS USING THE CHATANIKA AND EISCAT FACILITIES c32
G. Newton, P. J. Christiansen, and G. Martelli *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 383-385 (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

An experiment is proposed using the Chatanika transmitter and the EISCAT receiver, suitably tuned, for bistatic measurement of the polar ionosphere, from a minimum height of 650 km. This experiment can be performed only before the Chatanika transmitter is relocated in 1982. Author (ESA)

N81-10976# Tromsoe University (Norway). Inst. of Mathematical and Physical Sciences.
THE PARTIAL REFLECTION EXPERIMENT (PRE) FACILITY AT RAMFJORDMOEN, TROMSOE, NORWAY c46
O. Holt, A. Brekke, and T. Hansen *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 387-392 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The partial reflection method of determining electron densities and collision frequencies in the ionospheric D region, is briefly described. Possible applications of the observations to the study of turbulent fine structure in the propagation medium are mentioned. The PRE (Partial Reflection Experiment) facility at the University of Tromsoe's field site at Ramfjordmoen is described. The use of the facility in relation to and coordinated with other experiments (including rockets), is discussed. Author (ESA)

N81-10977# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
ACTIVE PLASMA STUDIES THROUGH GROUND-BASED EXPERIMENTS IN SCANDINAVIA c19
J. A. Fejer *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 393-397 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The ionospheric heating experiment near Tromsoe and its planned use for the study of a large variety of modification effects is described. The present status of the experiment and of the diagnostic facilities is outlined and some results of preliminary observations are briefly mentioned. Author (ESA)

N81-10978# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
THE HERO PROJECT: ROCKET EXPERIMENTS IN THE ARTIFICIALLY HEATED IONOSPHERE c19
G. Rose *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 399-405 refs Sponsored by Bundesminister fuer Forschung und Technologie (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Heating experiments will be carried out near Tromsoe, Norway: very powerful radio-waves transmitted upwards into the ionosphere give rise to artificially induced modifications of the natural ionospheric plasma. Many of these modification effects can be followed and interpreted by ground based diagnostic installations such as the EISCAT incoherent scatter facility. Some, however, require in situ methods. Therefore heating rocket (HERO) measurements will complement the ground based observations, gathering data on the modified F region plasma. The planned four payloads are described briefly. Author (ESA)

N81-10979*# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
NATURAL AND ARTIFICIALLY INJECTED ELECTRON FLUXES NEAR DISCRETE AURORAL ARCS c46
K. Wilhelm *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 407-410 refs Sponsored in cooperation with NASA (For primary document see N81-10914 01-99)

(Grant BMFT-01-OM-046-ZK-A-WRK-274/3)
Avail: NTIS HC A22/MF A01 CSCL 04A

A sounding rocket payload instrumented in order to inject and observe energetic electron fluxes in the ionospheric plasma was flown from Ft. Churchill into a bright auroral display on 9 April 1978. Measurements of one throw-away detector in three energy channels at 1.9, 4 and 8 keV are discussed in order to relate the observed electron echoes to the prevailing geophysical conditions. Author (ESA)

N81-10980# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
PLASMA WAVES PRODUCED BY AN ION BEAM: OBSERVATIONS BY THE VLF EXPERIMENT ON PORCUPINE **c75**
D. Jones *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 411-415 refs Original contains color illustrations (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Results are presented from the VLF electric field experiments flown on Porcupine flights F3 and F4, which also had ejectable xenon ion sources. The xenon ion beam was found to produce plasma instabilities whose frequencies could be linked to the local proton gyrofrequency. The main energy in the instabilities lies at 3kHz for events when the Xe+ source is close to the rocket, and at 7kHz when the source is farther away. Theory predicts that these frequencies should be the lower-hybrid-resonance and this implies that Xe+ is the dominant ion in the first case and that it is the ambient plasma that dominates later. There is no discernable antenna spin-modulation during the Xe events which indicates that the wave k-vectors are not unidirectional. A theory is cited based on the setting up of the proton cyclotron harmonic waves by the Xe+ or O+ cyclotron harmonic waves. The second Xe+ event on both flights exhibited an, as yet, unexplained harmonic structure related to half the local proton gyrofrequency. Author (ESA)

N81-10981# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
PLANS FOR A NEW MAGNETOMETER NETWORK IN NORTHERN SCANDINAVIA **c19**
B. Theile and S. Thuerey *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 417-420 refs Prepared in cooperation with Finnish Meteorological Inst. and Muenster Univ. (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Ground based magnetic field observations were carried out successfully during the operational phase of the International Magnetospheric Study (IMS). Information was gained about ionospheric and magnetospheric current flows during magnetospheric substorms. New magnetometers are planned for measurements during the operational phase of EISCAT. A north-south line along the Swedish-Finnish border will be made up of stations at Soeroeya/Norway, Alta/Norway, Kautokeno/Norway, Muonio/Finland, and Pello/Finland. Two further instruments are planned at the Finnish sites Kilpisjarvi and Kevo. The data will be recorded digitally, thus quick dissemination will be possible. The magnetometer data are useful for support of sounding rocket missions to study ionospheric and/or magnetospheric phenomena. Author (ESA)

N81-10982# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
THE HXR80M-BALLOON EXPERIMENT: A MICROPROCESSOR-CONTROLLED TRANSATLANTIC PAYLOAD **c60**
P. Ubertini, A. Bazzano, L. Boccaccini, C. LaPadula, M. Mastropietro, G. Medici, R. Patriarca, V. F. Polcaro, and F. Faggioni (PULSAR, S.R.L. Guidonia, Italy) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 425-429 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

A program in the hard X-ray astronomy field is presented. It consists of the development of high resolution large area multiwire proportional chambers to be employed in long duration balloon flights to study and monitor galactic and extragalactic sources. The flight configuration and performances of the HXR80M payload is described. The experiment is expected to fly during July 1980 from the Milo Base. The characteristics of the detectors employed, of the data handling electronics and in particular of the hardware and the software of the onboard microprocessor controlled multichannel analyzer are discussed. The limitations due to the low bit rate HF link (1.2 kbit/s) and the long flight duration (about one week) make imperative the use of an onboard microprocessor system to handle and select in real time the scientific data and to control the housekeeping and the telecommand systems. Author (ESA)

N81-10983# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
SEARCH OF A CYCLOTRON LINE AT 70 keV FROM CRAB NEBULA **c89**
P. Ubertini, A. Bazzano, C. D. LaPadula, V. F. Polcaro, and R. K. Manchanda (Tata Inst. of Fundamental Research, Bombay) *In* ESA European Rocket and Balloon Programs and Related Res. Apr. 1980 p 431-434 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

An observation of the Crab Nebula was made during a transmediterranean balloon flight launched on August 26, 1979 from Milo Base (Sicily, Italy). The hard X-ray experiment (HXR 79) carried a payload consisting of two multiwire proportional counters having a geometric area of 900 sq cm each. A single transit scan of the source wa performed on the Crab Nebula region at a float altitude of 2.9 mbs. The preliminary results indicate the existence of an excess flux between 64 - 76 KeV above the expected value of I/e sq power law. Author (ESA)

N81-10984# Liege Univ. (Belgium). Inst. d'Astrophysique.
AN IMAGE PHOTON COUNTING SYSTEM FOR SPACE ASTRONOMICAL OBSERVATIONS **c89**
S. Gardier, C. Jamar, J. P. Macau, and A. Monfils *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 435-443 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

The characteristics of the two main categories of image photon counting systems (parallel output and serial output) are briefly reviewed. A modified image photon counting method is then described. It is based on a pattern recognition logic and as such is truly bidimensional. In the presented version, the flexibility of a previous model, aiming at the simultaneous detection of adjacent events was exchanged for a better adaptability to the observed pulse width distribution function. The logical circuitry is described as well as the pulse analyzer. Illustrations are given of the results obtained. Author (ESA)

N81-10985# Bonn Univ. (West Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung.
SPECTROPHOTOMETRIC INVESTIGATIONS OF He-I/II RESONANCE EMISSIONS WITH A ROCKET-BORNE MULTISENSOR RESONANCE CELL INSTRUMENTATION **c89**
G. Lay, H. J. Fahr, and C. Wulf-Mathies (Tuebingen Univ., West Germany) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 445-448 refs (For primary document see N81-10914 01-99)
Avail: NTIS HC A22/MF A01

Terrestrial and extraterrestrial resonance emissions of neutral and ionized helium were observed by means of a multiresonance cell device on board a Skylark 12 rocket. Results from a flight from Natal, Brazil, are shown, and a preliminary data analysis given. Observations of drastically different height profiles in the 58.4 nm data registered with empty and with filled resonance cells were made. These differences are due to the predominance of multiple and singly scattered photons, respectively, originating in the helium geocorona. The extraterrestrial 58.4 nm emission peak is spectrally identified at 0.001 nm wavelength indicating only 3 k/m sec as a mean projected relative velocity of interplanetary helium atoms with respect to the earth. The 30.4 nm sensor is shown to be free from He I resonance radiation or other nonhelium radiation contamination. The 30.4 nm signal shows strongly pronounced variations with the solar aspect angle, clearly pointing to some extraterrestrial radiation which originates close to the sun (r about 0.3 AU). Author (ESA)

N81-10986# Bonn Univ. (West Germany). Inst. fuer Astrophysik und Extraterrestrische Forschung.
INTER-ZODIAK: A HIGH-APOGEE ROCKET EXPERIMENT

FOR THE OBSERVATION OF DUST-GENERATED NEUTRALS IN THE SOLAR VICINITY c89

H. J. Fahr, H. W. Ripken, and G. Lay *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 449-451 refs (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

The goals of this project are the obtaining of solar wind flux determinations in a region where existing technologies do not offer any access, between the solar corona and the perihelion of Helios spacecraft at .29 AU; the developing of a means for constant monitoring of the solar particle output in this region by using the planned instrumentation, after successful rocket flights, on Earth-orbiting platforms; providing dust density distribution measurements entirely independent of optical zodiacal light observations, also giving dynamical parameters of the orbiting dust grains. The scientific background (to clarify the reasons for certain demands imposed on the technology), the experimental requirements, and the Inter-Zodiak hardware development are described. Author (ESA)

N81-10987# Queens Univ., Belfast (Northern Ireland). Dept. of Pure and Applied Physics.

UNITED KINGDOM PROGRAMS IN BALLOON ULTRAVIOLET ASTRONOMY c89

B. Bates, W. Brown-Kerr, D. L. Giaretta, J. A. Mcquoid, A. Boksenberg (University College, London), M. Pettini (University College, London), W. A. Towlson (University College, London), and B. Y. Welsh (University College, London) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 453-460 refs Sponsored by the UK Science Research Council and the Ministry of Education of Northern Ireland (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

An outline is given of the astrophysical objectives and of the instrumentation employed in programs of balloon ultraviolet astronomy which are being carried out by the Queen's University of Belfast and University College, London. These studies are being made using star pointing stabilized balloon-borne platforms. The balloon observations are directed towards high spectral resolution studies of various types of stars to provide information on the interstellar gas and stellar atmospheres. The data obtained are complementary to the lower resolution studies being made by both group using the International Ultraviolet Explorer satellite. Author (ESA)

N81-10988# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.

EUROPEAN ACTIVITIES IN BALLOON-BORNE INFRARED ASTRONOMY c89

S. Drapatz *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 461-468 refs (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

A review of European activities in the field is presented, as well as an analysis of the significance of IR astronomy and of the advantages of balloon-borne telescopes. A list of the telescopes being used and their main characteristics is included. The goals are explained for each particular subject, including investigation of the solar system, formation and evolution of stars, structure of galaxies, and evolution of the universe. Author (ESA)

N81-10989# Leeds Univ. (England). Dept. of Physics.

A MICROPROCESSOR-CONTROLLED FAR INFRARED SPECTROMETER c35

A. R. Clarke and I. Kirk *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 469-476 refs Sponsored in part by UK Science Research Council (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

A balloon-borne far IR spectrometer for the investigation of extended sources was developed. A technique for the large angle surveying of IR emission from the galactic disk was developed in which the microprocessor performs the on-board control and data processing. The performance of the device under both laboratory and environmental chamber conditions is described. Author (ESA)

N81-10990# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).

THE MIDDLE ATMOSPHERE IONIZED COMPONENT c46

F. Arnold *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 479-496 refs (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

Current understanding of the middle atmosphere ionized component (MAIC) is reviewed, with an emphasis on in-situ composition measurements of electrically charged species. Concerning its typical structure which is characterized by a pronounced minimum of total charged particle concentrations around 60 km, the MAIC is divided in two regions: The lower ionosphere which results mainly from ionization of atmospheric gases by solar electromagnetic radiation, and the lower region extending from the tropopause to 60 km which will be termed stratospheric ionized component, which results mainly from ionization by galactic cosmic radiation. The review includes discussions of ionization recombination cycles, negative ion composition, lower ionosphere variability, positive ion composition ion induced aerosol formation and analytical applications of ion composition measurements. Author (ESA)

N81-10991# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Metal Casting.

THE POSSIBILITY OF USING SOUNDING ROCKETS IN MATERIAL-SCIENCE EXPERIMENTS c12

H. Fredriksson *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 497-506 refs (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

A theoretical analysis of different solidification phenomena was performed. Conclusions about the necessary study time schedule are drawn. It is shown that studies about structure control and precipitations in immiscible alloys are possible during rocket flights. Studies of solidification phenomena influenced by concentration variations could not be performed during short time flights. Author (ESA)

N81-10992# Max-Planck-Institut fuer Extraterrestrische Physik, Garching (West Germany).

THE BARIUM ION JET EXPERIMENTS OF THE PORCUPINE PROJECT c46

G. Haerendel *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 507-508 (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

The injection of a barium plasma from a sounding rocket by the shaped charge technique offers several possibilities that cannot be achieved by conventional releases. This is due to high initial velocities of the atoms of up to 14 km/sec. Most of the the applications are related to the great heights that the ions can reach, but some depend directly on the initial momentum. Typical applications are: tracing at high altitudes, modifications, and alternate Ionization processes. Project Porcupine contributions in this field are summarized. Author (ESA)

N81-10993# Technische Hochschule, Aachen (West Germany). Giesserei Inst.

MATERIALS SCIENCE RESEARCH UNDER MICROGRAVITY CONDITIONS IN THE GERMAN SPACE PROGRAM c12

P. R. Salm and H. U. Walter (DFVLR, Cologne) *In* ESA European Rocket and Balloon Programs and Related Res. Jun. 1980 p 509-520 refs (For primary document see N81-10914 01-99)

Avail: NTIS HC A22/MF A01

An overview of the German microgravity program is presented. Included are lists of the main subjects of study, the flight opportunities presented by missions of Texus 1, Texus 2, Texus 3A, Spar 1 and the first Spacelab project. Special emphasis is given scientific topics such as convective phenomena at the interfaces and interaction of inclusions with advancing solid-liquid interfaces. Comments are presented on some technologically oriented experiments such as the production of Mn Bi-Bi permanent magnet materials and the applications of skin technology. Author (ESA)

N81-10994# Joint Publications Research Service, Arlington, Va.

WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY NO. 5
27 Nov. 1979 85 p refs Transl. into ENGLISH from various European journals
(JPRS-74642) Avail: NTIS HC A05/MF A01

Welding techniques for underwater pipelines are examined. Computer controlled manufacturing and industrial energy conservation techniques are discussed. Other topics include long range heating sources, coal burning technologies, and nuclear power facilities. For individual titles, see N81-10995 through N81-11000.

N81-10995# Joint Publications Research Service, Arlington, Va.
JOINING PIPELINES BY HYPERBARIC WELDING c37
Guy Fleury *In its* West Europe Rept.: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 1-10 Transl. into ENGLISH from Industrie du Petrole (Paris), Jan. - Feb. 1979 p 73-81 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

The standard procedure for connecting underwater pipelines and high pressure welding methods are outlined. The method applied uses pipe handling methods and a process of dry welding in a high pressure atmosphere. E.D.K.

N81-10996# Joint Publications Research Service, Arlington, Va.
COMPUTER-CONTROLLED MANUFACTURING c31
In its West Europe Rept.: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 32-40 Transl. into ENGLISH from Handelsblatt (Duesseldorf), 8 Oct. 1979 p 192-195 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

The situation of production enterprises in the highly developed industrial countries is characterized by growing market demands for quality and product delivery times, as well as by an increasing pressure of costs due to steadily stiffening competition. Thus, the need arises in the production area to use more efficient automated production techniques as well as to improve planning and control of the production process by using computer based production control systems. E.D.K.

N81-10997# Joint Publications Research Service, Arlington, Va.
INDUSTRIAL ENERGY CONSERVATION TECHNIQUES EXPLORED c44
G. Baller *In its* West Europe Rept: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 41-46 Transl. into ENGLISH from Energie, Graefelfing, West Germany nos. 8-9, Aug. - Sep. 1979 p 110-114 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

It is well known that of the total terminal energy purchased in the industrial area, on the average, only about 55 percent is converted into useful energy. Types of useful energy are heat, mechanical energy, light, and useful energy for physical/chemical processes. About 45 percent of the paid for energy are therefore to be accounted as losses, in the conversion, transport, distribution, storage, and application of energy. Naturally, part of these losses is unavoidable for purely physical reasons. However, a considerable potential for savings remains which should challenge every operations engineers. E.D.K.

N81-10998# Joint Publications Research Service, Arlington, Va.
FEASIBILITY OF LONG-RANGE HEAT TRANSFER EXAMINED c34
E. Windorfer *In its* West Europe Rept.: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 50-57 refs Transl. into ENGLISH from Brennstoff-Waerme Kraft (Duesseldorf), Aug. 1979 p 334-336 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

The problems connected with the initial phase in the construction of a long range heating supply, the dependence of its expansion on the price level, and accompanying measures for accelerating customary hook up activity are described. An example of such a system is the long range heat supply system of the city of Flensburg. E.D.K.

N81-10999# Joint Publications Research Service, Arlington, Va.
STATES CONSIDER NEW COAL-BURNING TECHNOLOGIES c28
In its West Europe Rept.: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 58-61 Transl. into ENGLISH from Energie (Graefelfing, West Germany), Jul. 1979 p 228-229 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

The proportion of plants operating with petroleum products must be reduced in order to more completely decouple the electric power supply from the imponderables of the petroleum supply. In this connection, the resolute expanding of long range heating systems is being heavily stressed in the energy policy of Berlin. Ecologically safe technologies such as the fluidized bed furnace are already an element of Berlin's deliberations with respect to coal. E.D.K.

N81-11000# Joint Publications Research Service, Arlington, Va.
USE OF NUCLEAR POWER FOR COAL CONVERSION PROPOSED c44
In its West Europe Rept.: Sci. and Technol., No. 5 (JPRS-74642) 27 Nov. 1979 p 62-65 Transl. into ENGLISH from Energie (Graefelfing, West Germany), Jul. 1979 p 264 (For primary document see N81-10994 01-99)
Avail: NTIS HC A05/MF A01

It is proposed that through a combined action of coal and nuclear energy the problem of a secure energy supply in the late 20th century can be solved. A study comparing electricity costs between coal and nuclear energy, carried out by the Battelle Institute on behalf of the Land of North Rhine-Westphalia, found that if indirect costs are ignored, nuclear energy has a price advantage of 3.27 pfennigs/kWH in the base load range. Only in the peak load range is electricity generation with coal cheaper, by 2.02 pfennigs/kWH. E.D.K.

N81-11001# Joint Publications Research Service, Arlington, Va.
WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY NO. 4
21 Nov. 1979 105 p refs Transl. into ENGLISH from various European journals
(JPRS-74613) Avail: NTIS HC A06/MF A01

Research and development programs concerned with civil technology are addressed. Included are presentations dealing with energy technology, aerospace technology, transportation, information systems, and technology development. For individual titles, see N81-11002 through N81-11006.

N81-11002# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF ARIANE'S MAJOR COMPONENTS DISCUSSED c15
M. Desloire *In its* West Europe Rept.: Sci. and Technol., No. 4 (JPRS-74613) 21 Nov. 1979 p 9-35 refs Transl. into ENGLISH from L'Aeronauti. et L'Astronaut. (France), no. 77, 1979 p 35-48 (For primary document see N81-11001 01-99)
Avail: NTIS HC A06/MF A01

The development plan for the Ariane launcher structures is described. The structure design specifications, size specifications, methods of calculation used, and static and dynamic testing are discussed in detail. The safety margins obtained for the various structures are also addressed. M.G.

N81-11003# Joint Publications Research Service, Arlington, Va.
IMPROVED THERMAL INSULATION IN POWER PLANTS DISCUSSED c24
W. E. Fuchs *In its* West Europe Rept.: Sci. and Technol., No. 4 (JPRS-74613) 21 Nov. 1979 p 39-47 refs Transl. into ENGLISH from Brennstoff-Waerme-Kraft (Dusseldorf), no. 9, Sept. 1979 p 353-355 (For primary document see N81-11001 01-99)
Avail: NTIS HC A06/MF A01

The difficulties in specifying an economical thermal insulation thickness for the system components of power plants are identified and analyzed. It is shown that customary insulation

thicknesses on steam generator walls and also on pipelines, channels, and containers allow an excessive and uneconomical loss of heat. By means of diagrams, it is made clear that economical insulating layers will require more material. M.G.

N81-11004# Joint Publications Research Service, Arlington, Va.

VW PROGRESS IN VEHICLE ACOUSTIC TECHNOLOGY EXAMINED **c71**

Ulrich Sorgatz *In its* West Europe Rept.: Sci. and Technol., No. 4 (JPRS-74613) 21 Nov. 1979 p 61-78 refs Transl. into ENGLISH from Automobil Industrie (Wuerzburg, West Germany), no. 3, Sep. 1979 p 47-54 (For primary document see N81-11001 01-99)

Avail: NTIS HC A06/MF A01

Problems associated with acoustic damping in front wheel drive vehicles are identified and remedial design efforts are described. Since the entire starting or displacement moment must be reacted through the power plant bearings, acoustic requirements for as soft a bearing as possible are in conflict with a specification of a maximum allowable power plant rotation angle (which limits the strength of the exhaust installation) and is also in conflict with engine-related driving behavior (stress cycles, upturn effect). This compromise requires that the theme of power plant damping be pushed to its technological limits. Modern light construction of car body attachment further reduces mass impedances. Airborne sound damping is also addressed. M.G.

N81-11005# Joint Publications Research Service, Arlington, Va.

NEW MEASURES IN FAVOR OF INNOVATION **c85**

In its West Europe Rept.: Sci. and Technol., No. 4 (JPRS-74613) 21 Nov. 1979 p 79-84 refs Transl. into ENGLISH from Le Progress Technique (Paris), no. 14, 1979 p 7-9 (For primary document see N81-11001 01-99)

Avail: NTIS HC A06/MF A01

The functions of French governmental agencies which aid in stimulating technological innovation are described. Technology transfer, financial aid, technology assessment, and management duties are outlined. M.G.

N81-11006# Joint Publications Research Service, Arlington, Va.

NEW CENTRAL S/T INFORMATION SERVICE LAUNCHED **c82**

In its West Europe Rept.: Sci. and Technol., No. 4 (JPRS-74613) 21 Nov. 1979 p 85-91 refs Transl. into ENGLISH from Le Progress Technique (Paris), no. 14/79 p 19-21 (For primary document see N81-11001 01-99)

HC A06/MF A01

The French Central Information Service is briefly described and the social, political, and economic implications of the system are addressed. The computer is accessible through all available public networks. Users interrogate the center through conversational terminals. System hardware is briefly described. M.G.

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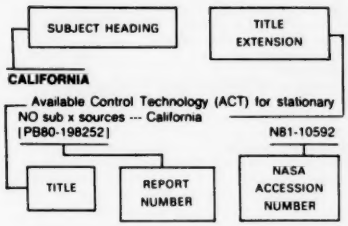

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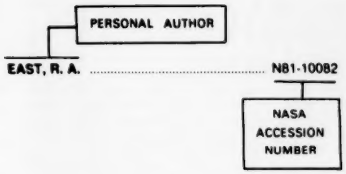

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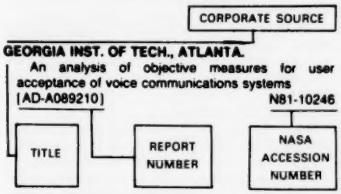

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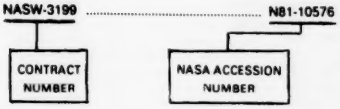

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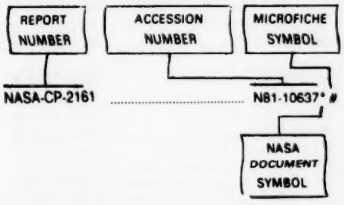

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